The Shape and Implications of Korea's Telecommunication Industry:

Crisis, Opportunity and Challenge

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Abstract

This article aims to provide readers with a better understanding of the telecommunication industry in Korea by reviewing its development and progress. Firstly, a brief history of Korean telecommunications is supplemented by an overview of the social and economic factors the Korea is experiencing. Secondly, this paper focuses on the government's role as a key player within industry and relevant policy is then analysed. Thirdly, an analysis of the market competition and regulation systems as well as customer protections is conducted. Finally, IoT and 5G as technologies are introduced as well as new services that Korea is currently focusing on, to enable it to continue leading the global market into the future. The 3 key themes that emerge through this paper are crisis, opportunity and challenge.

Introduction

The term 'digital society' has become a common expression used to define today's technology driven lifestyle. Innovative technologies that have been introduced have generated dynamic discussions regarding social activities as a whole. It has become clear that the areas leading the change are that of the ICT and related internet industries.

Within this general context, South Korea has been in the spotlight of discussion during recent years due to the visible results emerging from its highly developed ICT environment. South Korea tops the ranking in terms of households with internet in the ICT Development Index established by the International Telecommunication Union (ITU), with 98.5% of

Korean households having access to the internet. The Index also notes that 84.3% of the population has used the internet (ITU 2015). Due to this, Korea is often used as a benchmark by many countries seeking development of their ICT infrastructure. However, it was not until the 1990s that the Korean telecommunications industry had become a focal point for researchers and policy makers.

How did Korea achieve such ICT success in such a short period of time? How did Korea become globally competitive within the industry? How did the government, policy and market regulations influence the process? And how can Korea continue to maintain its global leadership in the coming years?

To answer these questions, this paper will examine the dynamic features of Korea's telecommunication industry. It will also discuss some of the implications for countries that are trying to become more globally competitive. This is achieved by altering the rules and regulations of the telecommunications industry to promote growth and fair competition within the marketplace. Firstly, it will provide a brief history of telecommunications in Korea from a social and economic context. Secondly, an explanation of the key role played by the Korean government and the policies implemented are shown. Thirdly, competition and regulation within the market system, and discuss consumer protection will be outlined. Finally, technologies and services that Korea is currently developing to maintain their status as a leading country will be briefly examined.

Brief history

Modern telecommunications in Korea began with the launching of a telegraph service between Seoul and Inchon city on October 28th, 1885. For more than one hundred years, the telecommunications industry developed gradually as a series of government sponsored projects until it was formally nationalised into a state-run monopoly in the 1970's, as was the case in many other developed nations during that same period.

A few years after the Korean War came to an end, the Korean economy began to grow again, leading to a surge in telephone usage among Koreans. This prompted the government to recognise the telecommunications industry as a national priority with the potential to connect citizens while increasing economic activity. To better harness the potential of telecommunications technology, the Korean government revised its plan for the industry.

In December 1981, the Korean government began privatisation of the industry by releasing Korea Telecom Authority – KTA (later renamed KT) from government control. At the time, KTA was the exclusive service provider of telecommunication in Korea – being fully owned and operated by the Korean Ministry of Communications. Five years later, KT completed a

long-distance digital switching network and automated all of its telephone lines and has continued to make some visible outcomes.

In 1984, a new privately held telecommunications company named Korea Data Telecom (KDT) entered the industry by developing a value-added network (VAN). This eventually allowed the information sector to grow within the telecommunications industry. Soon afterward, Korea Mobile Telecommunication Co. (now SK Telecom) and LGU+ entered the market, providing network, mobile, and internet services as privately-held companies. Finally, by 2002 KT had been fully privatised as the Korean government sold off the remainder of its shares to private investors. Through this process, the market moved from a state-run monopoly into an Oligopoly, centred on competition (Cho 2002).

It is important to note that the Korean government wanted the industry to become more competitive. To achieve this end, and to move away from being a state-run monopoly, it auctioned off two licences, which eventually allowed SK telecom and LG U+ to enter the industry. Market forces eventually played out as these new entrants competed with KT for market share resulting in an oligopoly. Hence, government policy as well market competition had an influence on the outcome.

These rapid changes in market structure from a government-run monopoly into an oligopoly resulted in fundamental changes to the industry. Due to the series of policy changes that were aimed to create competition, the telecommunication industry expanded rapidly. Increased industry competition led to improvements in technology to satisfy customer demand. Some researchers assess this as a transition period into a quality-oriented competitive system. The government set a goal to increase the penetration of telecommunications infrastructure throughout Korea. Since then, they have installed more than a million lines every year since 1982. With the total number of telephone lines exceeding 10 million in 1987, Korea opened the era of one telephone per household (Cho 2002). As of 2015, wire telephone subscribers have exceeded 26 million. This means that on average, there are at least two lines per household when considering the whole population of 51 million people. See Table 1 for the trends of telephone penetration during the 1980's in Korea.

Table 1 Telephone penetration in Korea during the 1980s

Classification	1983	1985	1988	1990
Telephone lines (Thousand)	5,337	7,538	11,239	15,293
Subscribers (Thousand)	4,810	6,517	10,306	13,276
Per 100 inhabitants	12.0	15.8	24.6	31.0

*. Source: Cho, S. 2002. Telecommunications and Informatisation in South Korea. *Netcom 16,* 1-2.

The second turning point in Korean telecommunications was during the 1990s. During this period, Korea developed its own satellite communication and broadcasting systems, launching three satellites called Koreasat 'Moogoongwha 1', 'Moogoongwha 2' and 'Moogoongwha 3', the first two being sent out in 1996 and the third in 1999.

It is important to note that the Korean economy experienced its worst recession in 1998. At the time, Korea lacked foreign exchange reserves, and was bailed out by the International Monetary Fund (IMF). The Korean economy appeared hopeless in the aftermath of the financial crisis (Lee & McNulty 2003; Ypsilantis & Min 2000).

Surprisingly, the Korean economy managed to recover quickly and gain momentum. During that time there was a worldwide boom in the ICT industry generating many new productive opportunities. Korea was able to capitalise on this trend, and managed to develop its domestic ICT infrastructure while establishing its own ecosystem of production within the industry – with the emergence of many new companies. Growth came rapidly without interruption, and many of these new investments in ICT became profitable. The value added from ICT production in 2000 accounted for 13.4 percent of GDP, which was a significant increase from 8.6 percent in 1997. Total ICT production rose from 81.1 trillion won in 1998 to 115.0 trillion won in 1999 and 148.2 trillion won in 2000 – up 30.5 percent in 1999 and 28.9 percent in 2000 in comparison to the previous year. Korea considers itself to still be experiencing the ICT boom. This boom has been spurred on by the development of a number of new technologies including mobile phones, internet-related industries, broadband, digital-TV, and wireless Internet. The emergence of this wide variety of new technologies has played a crucial role in boosting economic activity alongside the traditional IT industries such as personal computers (PC) and semi-conductors (Ypsilantis & Min 2000).

The recession provided Korea with both crises and opportunity. Several exemplary companies, such as KT, SK telecom, and LG U+ were able to become more competitive primarily due to the Korean government's strategic policies.

The Korean government viewed the financial crisis as an opportunity to change their economic constitution. Considering the global trend such as ICT boom, the government

actively provided policy support to foster the telecommunication industry. Telecommunication companies followed government policy as well, and have developed their global competitiveness through domestic market competition. The recession was a catalyst to improve the industry and its related environments.

Based on this competitiveness, the companies are still considered to be prime movers within the telecommunications industry, having played a key role in leading the recovery. Since the mid of 1990s, this group of companies has maintained a dominant share of the market in the majority of sectors within the telecom industry. Among with these companies, KT maintains the largest share in telephones, Internet Protocol Television (IPTV) and satellite markets, while SK telecommunication is the primary player in the market for mobile phones. LG U+ has maintained third position in the market for wired telephones, mobile, high speed internet and IPTV. However, when looking at the Internet of Things (IoT) sector, LG U+ lead the market, allowing it to maintain a competitive advantage since 2015 when it launched its first IoT service in Korea. See Table 2 for the market shares of telecommunication companies by business sector in Korea.

Table 2: The market share of telecommunication companies by business area

	Mobile phone	Wired telephony	High speed Internet	IPTV
KT	28.8%	80.5%	49.7%	46.4%
SK Telecom	50%	16.3%	29.5%	30.5%
LG U+	21.1%	3.1%	20.7%	23%

*. Source: www.msip.go.kr. The ratios in this table have differing reference point. IPTV data is as of August 2016 and the others are as of the end of 2015.

Figure 1 gives an overview of the progress and current status of Korea's ICT environment. According to the National Information Agency (NIA) of Korea, 82.1% of the population have used the internet and 95.5% have used mobile ICT devices. When looking at the figures for e-cash usage, internet banking and volume of online shopping, we can observe the market has grown significantly. When looking at internet speed, the majority of Koreans have enjoyed broadband internet averaging 23.6Mbps. Additionally, the broadband penetration rate runs at 94% of users (NIA 2014), which means that almost everyone in Korea has access to the internet while enjoying a high speed. It is important to note that Korea is currently the country with the fastest internet speed, and the highest rate of access in the world.
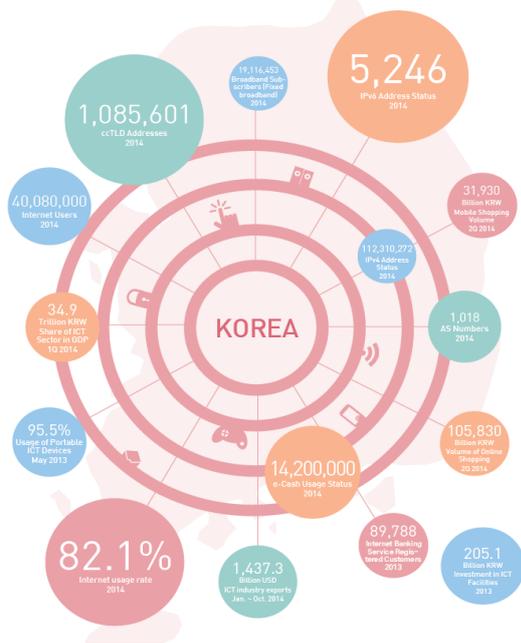
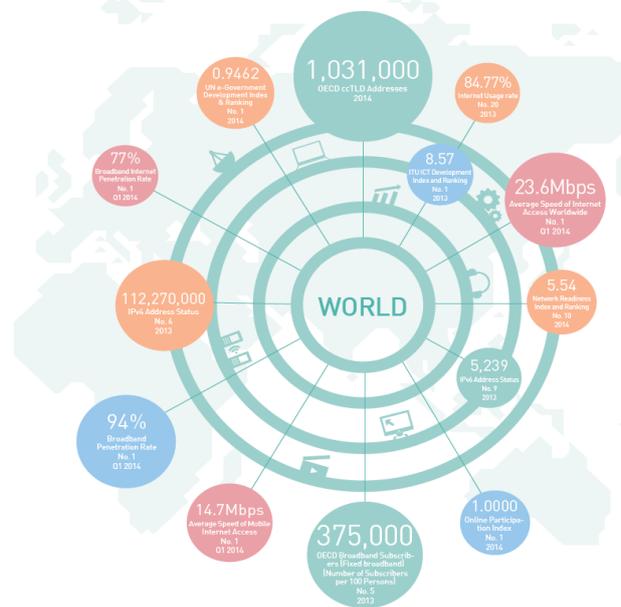**Figure 1 Progress and status overview of Korea ICT environment as of 2014**

Source: http://www.nia.or.kr

Government and policy

Constructing an effective national telecommunication and information infrastructure has become one of the highest priorities among governments around the world. The purpose of a nation's telecommunications infrastructure is no longer exclusively used to search for information and to communicate; policy makers should view it as a fundamental pillar for citizens' economic participation, contributing to its the social digital fabric while promoting economic competitiveness in the global marketplace. That may be the reason why governments around the world have decided to improve their ICT infrastructure, and Korea has been no exception to this trend.

In order to quickly adapt to changes in the telecommunications environment, the government body in charge of ICT related policies has been re-organised four times since 1980. For example, television technology evolved into IPTV, leading to the convergence of telecommunication related services and media broadcasting into a common sector. This eventually resulted in the restructuring of government bodies overseeing these areas in order to better suit the evolution of the marketplace.

Whenever a new president came into power, the name of the government body overseeing the sector was updated and its structure was reorganised. However, what has remained constant is the government's role in supporting and encouraging the industry. Originally the Korean Communication Commission (KCC) was the sole government body overseeing the

industry. However from 2013 onwards, KCC has maintained its role of regulating the industry while an additional organisation called Ministry of Science, ICT & Future Planning (MSIP) was created to promote growth. It was reasoned that two specialised organisations could more effectively manage the industry than a single large one. In this regard, whether this separation was more effective is still a matter of contention. See Table 3 for the regulatory changes in telecommunication and broadcasting in Korea since 1980.

Table 3 Korean regulatory reform in broadcasting and telecommunications

	1980	**2001**	**2008**	**2013 - present**
Broadcasting	Ministry of Culture and Tourism/Korean Broadcasting Communication (MCT, KBC)	Korea Broadcasting Commission (KBS)	Korea Communications Commission (KCC)	Korea Communications Commission (KCC)
Telecommunication	Ministry of Information and Communications (MIC)	Ministry of Information and Communications (MIC)		Ministry of Science, ICT and Future Planning (MSIP)

MSIP, newly established in 2013, primarily deals with promoting the industry while KCC focuses on maintaining market regulations among market participants. In terms its role as a commissioner and regulator, KCC is equivalent to the Federal Communications Commission (FCC) of the U.S. However, the two commissions are different in terms of their range of responsibility and status, since KCC only oversees regulations related to the telecommunication and broadcasting market, whereas the FCC has a broader mission (D. Kim, 2011).

Previous studies have shown that the role of the Korean government in developing the ICT environment was far reaching and profound. According to previous studies (Cho 2002; Shin 2007; Kim 2016; Rhee 2016; Hong, Byun, & Kim 2016), the government's role can be classified into direct or indirect. Shin's study (2007), analysed ICT policy and the Korean government's role therein, thus providing a clearer viewpoint from which to understand the relationship between government and industry. The research shows the direct role that the Korean government played in developing the industry. This participation was classified them into four parts: controller, builder, regulator and market investor. Secondly, Shin (2007) classified the role of the government as an indirect facilitator into four distinct indirect roles: strategist, guider, leader and integrator. See Table 4 for each role of Korean government for the ICT industry.

Table 4: Roles of the Korean government for the ICT industry

Direct role	Indirect role
A controller: • To set goals and guidelines for private industries to follow • To maintain effective market conditions for industry allowing players to compete	**A strategist**: • To be the main organisation that develops a vision for the country. Taking on a leadership role • To define the direction of future growth • To Allocate the appropriate resources in order to reach the information age within Korea
A builder: • To provide the physical infrastructure that would allow citizens to access information on the internet	**A guider**: • To maintain the proper environment for innovation and growth in ICT. • To channel and mobilise financial and human resources within the ICT sector and related activities
A regulator: • To create an environment for fair competition to deter fraudulent, undesirable businesses practices • To create an environment for risk taking in business without encouraging rampant abuse of the system	**A leader**: • To establish ICT as a national priority • To provide a national plan for ICT and networked readiness • To launch large ICT projects • To accelerate ICT adoption by government departments and the public sector, for example, by promoting e-government
An investor: • To be a producer and buyer of ICT and ICT-related products. Provide tax incentives and special grants • To encourage local enterprises • To invest in technology so as to exploit the new medium of trading	**An integrator**: • To ensure that the various programs and projects, such as Digital Cities, are well integrated • To become a cohesive strategy in allowing Korea to thrive in the information age

Source: Shin, D. 2007. A critique of Korean National Information Strategy: Case of national information infrastructures. *Government Information Quarterly*, 24(3), 624-645.

Considering these changes, one can estimate that the Korean government has actively intervened in newly emerging markets in order to quickly make them more globally competitive. The government may have also come to the conclusion that waiting for the market to mature without government intervention could have taken too long to yield desirable results.

The Korean government has strongly intervened in the ICT industry with systematic and specific policies to carry out its planned strategies since the 1980s. In 1984, the Korean government started the first phase of development of the National Basic Information Strategy (NIS), in which it created five major networks. They are: the National Administration Information System; the Financial Information System; the Education and Research Information System; the National Defence Information System; and the National Security Information System (Jeong & King 1996; Shin 2007).

From 1987 to 1991, the NIS aimed to establish IT as the foundation of economic growth in Korea by building the physical computer networks of the National Computerisation Agency (NCA). The second phase involved the deployment of Korean Information and Communication Infrastructure (KII). The government successfully connected public and private infrastructure throughout Korea, and as a result, was able to provide the Korean economy with a competitive advantage, as most other countries had yet to establish a robust ICT environment.

Following the success of KII, Korea improved its existing ICT strategy to adapt to advances in technology by developing a new phase dubbed IT839, named after eight services (Wibro, DMB, Home network, Telematics, RFID W-CDMA, Terrestrial D-TV, and Internet telephone (VoIP)), three infrastructures (BcN, U-sensor network, and IPv6), and nine new growth engines (Next-generation mobile communication, Digital TV, Home network, IT SoC, Next-generation PC, Embedded SW, Digital content, Telematics, and Intelligent service robot). The Korean government aims to lead the development of these projects while establishing standards that will be adopted worldwide. In the process, they hope to achieve a "first mover" advantage for Korean companies involved in the production and development of new devices and components. Compared to its previous projects, which were no more than technical roadmaps, IT839 has a more comprehensive view focusing on interconnectivity between infrastructure, services, and applications.

Previous focus has been on simple IT investment and strategy was centred on the outcomes and benefits of individual projects. IT839 focused on the development of the basic telecommunications infrastructure for Korea. In addition, IT839 followed a realistic plan of action aligned with a national strategic blueprint (Shin, 2007). The implementation of this policy and strategy created remarkable outcomes. Korea established itself as a competitive player in the global market while becoming a leader in the majority of ICT related domains. In 2006, spurred by its own success, the Korean government revised the IT839 strategy, with the goal of creating a ubiquitous network environment throughout Korea, dubbing this updated strategy u-IT839. In 2013, a partially updated strategy named ICT WAVE was launched by the newly elected Park Geun-hye administration which focused on achieving four goals. Firstly, developing the world's leading ICT environment, secondly activating R&D ecology, thirdly revitalising the ICT related industry, and finally enhancing life in general. Implementation of these initiatives has continued to be successful. See Table 5 for ICT policy and strategy implementation in Korea during the last 30 years.

Table 5 strategies established in Korea for ICT development and policy goals set by the strategies

	NIS	KII	IT839	u-IT839	ICT-WAVE
Goal	IT for economic growth	Deploy information and communication infrastructure	Promote information society	Revising and updating IT839 and Ubiquitous networks	World best ICT, Activating R&D ecology, Vitalising industry, Enhancing life
Period	1987-1991	1993-2000	2004-2006	2006-2012	2013-2017
Administration	National Computerisation Agency (NCA)	National Computerisation Agency (NCA)	Ministry of Information and Communication (MIC)	Ministry of Information and Communication (MIC)	Ministry of Science, ICT and Future Planning (MSIP)
Focus	Building physical computer networks	Building information system	Architecture, standard, interoperability and interface of IT service and Infrastructure	Convergence Service	Leading future technology such as IoT, 5G and developing its related service
Achievement	Basic networks building	Interconnecting public and private infrastructure	Upgraded Korea's IT level, IT industry's revitalisation	Unknown	

Source: Shin, D. 2007. A critique of Korean National Information Strategy: Case of national information infrastructures. Government Information Quarterly, 24(3), 624-645. www.msip.go.kr, www.kcc.go.kr. Some of content within table was modified and supplemented by the author.

Competition, regulation and protection

Market competition

After separating KT from government, Korea has kept its telecommunications market open in order to promote competition based on the principles of market liberalisation. Since then, the regulatory framework in Korea has undergone progressive reforms by abolishing unnecessary legal impediments in order to facilitate the entry of firms which provide telecom infrastructure and related services. This means that if any player in the market meets the legal conditions, they may operate a business in the field of telecommunications. This policy has enabled enhanced competition in several telecommunication related industries such as wired, mobile and value-added markets.

Recently, due to the advancement and convergence of ICT related technologies, markets which had once been distinctly differentiated, can now be viewed as whole. This trend of convergence has fostered an environment of increased competition while a variety of media platforms and services have emerged allowing the industry to become more competitive vis-a-vis its global counterparts. In the past, telecommunication companies had been restricted to providing basic telephone service only, but are now offering a variety of options such as

broadcasting, mobile, and internet related products and services. This means that the boundary between telecommunication and broadcasting has become blurred and competition between markets has accelerated. Since the year 2000, telecommunication operators have provided broadcasting services, while broadcasting companies have profited by selling them content. At the moment, these two business concerns no longer operate independently, requiring us to understand them as a single market having participants duelling in a reciprocal competitive relationship. And this phenomenon, where all products and services have converged into a single competitive market, has become more prevalent in Korea than any other country around the world.

An exemplary case of market convergence in Korea is IPTV provided by the three major telecommunication companies (KT, SK telecom and LG U+). IPTV can be defined as multimedia services such as television/video/audio/text /graphics/data delivered over IP based infrastructure (Newslog, 2006). Triple play service (internet, wired telephone and IPTV) or quadruple play service (internet, wired telephone, IPTV and mobile phone) are also regarded as services provided by telecommunication companies and are a representative case showcasing convergence and competition within a liberalised market.

As a result of market convergence, companies once operating separately within their distinct markets have begun to cross their traditional boundaries and are now competing directly with existing players. Many conflicts have arisen as more competitors are competing for the same share of customers.

Currently, conflicts among stakeholders have led to a public debate about many issues such as whether or not telecommunications companies should be permitted to leverage their market power by use of exclusionary bundling (Kang 2016), what rules should be applied when calculating the cost of retransmission for broadcasting content (Choi 2015), and how should the profit be shared between stakeholders when content is broadcasted over a network (Kim, Park, & Baek 2015). These conflicts are still ongoing. Every market stakeholder, including the government, is searching for the best solutions. See Figure 2 explaining the conflicts from between stakeholders within the Korean telecommunications and broadcasting market from 1990's until the present.
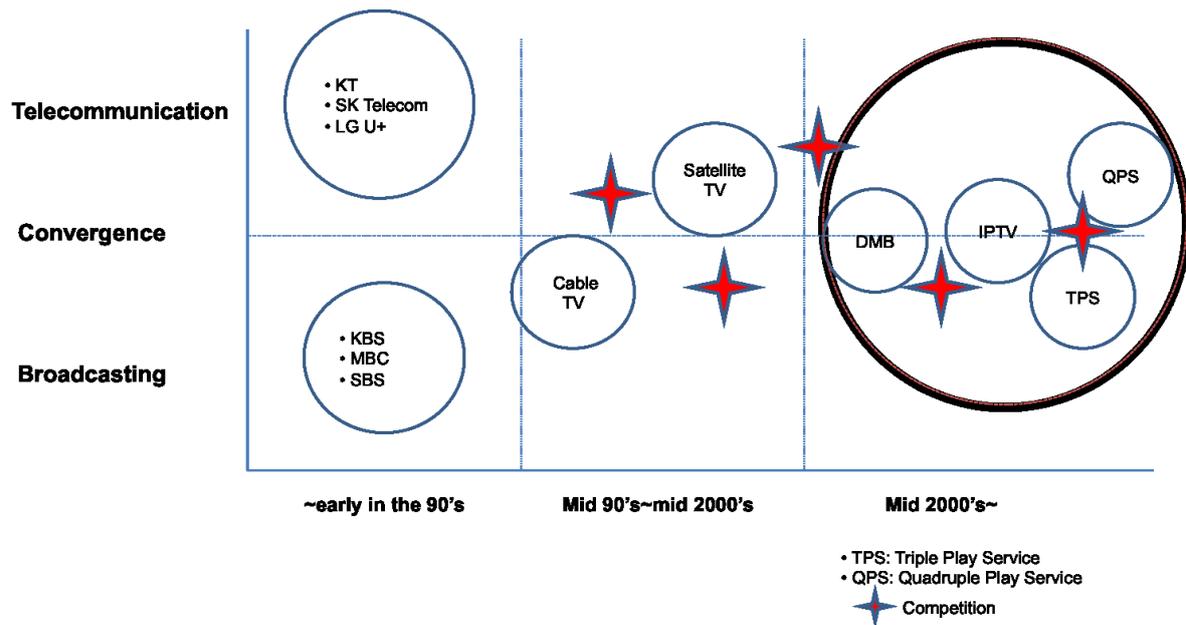
Figure 2: The competition among players evolved in Korea since 1990's

Regulatory framework

The regulatory framework is regarded as one of the most important considerations for the development of industry. Almost all of players in the market start from setting direction and range of business within the regulatory framework. Regulatory frameworks serve as a guide arm to players within the industry influencing the direction of market activity. Market regulations should be explicitly defined, and consistent, in order to provide market participants with a stable and predictable business environment (Mazzucato 2016).

Within this general context, MSIP and KCC have progressively reformed and implemented regulations in order to liberalise the telecommunication service market and introduce competition. Post-1980, the Korean Telecommunication and Information Acts have helped shape the country's current regulatory frameworks. Table 6 illustrates the key areas of the Acts.

The two key Acts for telecommunication services are the *Telecommunications Basic Act* and the *Telecommunications Business Act*. The purpose of the *Telecommunications Basic Act* is to contribute to the enhancement of public welfare by managing telecommunications effectively and stimulating the development of the industry. A significant portion of the Act is taken up by clauses on the 'promotion of telecommunication technology', promotion of research, technical criteria (standards), providing MSIP with authority to 'adopt new telecommunication modes', promotion of standardisation, type approval issues, etc. For regulatory reform, the *Telecommunications Business Act* (TBA) is more relevant than the

Telecommunications Basic Act. The TBA is concerned with defining the types of businesses within the telecommunications industry, licensing, cancellation of licenses, telecommunications business practices, promotion of competition among telecommunication service providers, the installation, and maintenance of telecommunication facilities and penal provisions.

The legislation for informatisation has consisted of two key acts, the *Basic Act on National Informatisation* and the *Information and Telecommunication Construction Business* Act. Here, the term "informatisation" means the making of activities in each sector of society possible, or facilitating the efficiency of such activities, by producing, distributing or utilising information.

According to National Informatisation Act of Korea, the *Basic Act on National Informatisation* was designed to identify the principles to build an information society. The legislation contains a basic action plan to actively promote the digitisation of Korean society. In contrast, the *Information and Telecommunication Construction Business Ac*t lays down the rules and regulations for the construction of telecommunications infrastructure firstly classifying businesses involved in the construction of telecommunications facilities, then by setting the licensing criteria for those businesses within the scope of the industry.

Table 6 Regulatory frameworks to influence telecommunication and broadcasting market

Legislation	Intention of legislation
Telecommunication Act (created in 1983 and revised several times)	• Established guiding principles for telecommunications • Gave Ministerial authority regarding the promotion of telecommunications technology and technical standards • Managed telecommunication networks • Defined the organisation and operation of the telecommunications minister
Telecommunication Business Act (created in 1983 and revised several times)	• Established licensing criteria and reporting procedures for telecommunication service providers • Established safeguards for competing service providers • Established the rights of telecommunication service users
Information and Telecommunication Construction Business Act (created in 1971 and renamed in 1997 after being revised several times)	• Established guiding principles for telecommunications construction principles • Classified the types of construction business, established licensing criteria and scope
Basic Act on National Informatisation (created in 1995 and renamed in 2009)	• Established the basic guiding principles on building information society • Defined a basic and action plan for informatisation promotion • Operates the informatisation promotion fund

Source: Ministry of Science, ICT and Future Planning, http://www.msip.go.kr/web/main/main.do

Consumer protection

The interests of consumers in the Korean telecommunication industry will continue to be enhanced through effective competition, which eventually could lead to lower prices, improved choice, and better quality, thereby improving the welfare of consumers. To achieve these desired results, it is clear that the government continues to play a key role. It has established a set of institutions such as the Industry Ombudsman and the Customer Complaints Centre while operating organisations overseeing the industry (KCC & FTC); this allows it to behave as a social device to protect consumers in the market. The missions of the KCC and the FTC (Fair Trade Commission) are to observe and when necessary, punish unfair trading practices within the telecommunication market. Based on this regulatory framework, some industry pundits claim that telecommunication companies are overburdened by a set of regulations. Whether or not this may be the case, the Korean government continues to maintain this system with the belief that it will lead to a more beneficial market, even though there have been some controversies regarding the effectiveness of it.

The aspects of customer protection have been specified by the law and legislation. As we see in Table 6, the *Telecommunications Business Act* identifies the rights of telecommunication service users. According to this legislation, telecommunications operators in Korea must establish steps to resolve consumer complaints. These complaints can be resolved at either customer service centres, at the ombudsman (which consists of outside experts), or by organisations aiming to narrow the digital divide (for example the informatisation & promotion committee).

Based on these organisational and institutional devices, consumers may claim compensation from operators in a number of ways as mandated by the consumer protection regulation described in these telecommunications acts. These include protection from double billing, property damage from telecommunication facilities installations, and overpayment from operator errors. The KCC maintains a Consumer Complaints Centre and requires telecom companies to report consumer related complaints to them. The telecommunications companies also have a means to seek redress from complaints while seeking appropriate actions from the Minister. If carriers fail to reach an agreement with consumers who continue to seek compensation, they are allowed to request intervention by the KCC who can then arbitrate the dispute under the Telecommunications Basic Act.

The future

What's next? The answers that Korea has regarding this question are divided into two parts. The strategic move for Korea in leading the market has been a focus on Internet of Things

(IoT) and 5th generation (5G). These two areas are essential in the continued competitiveness of Korea's telecommunication and digital sectors.

Internet of Things (IoT)

The concept of IoT describes a system where objects in the physical world, and sensors within or attached to these objects, are connected to the Internet via wireless and wired Internet connections. These sensors can use various types of local area connections such as RFID, NFC, Wi-Fi, Bluetooth, and Zigbee. Sensors can also have wide area connectivity such as GSM, GPRS, 3G, and LTE (Kumar et al 2016). In other words, IoT establishes an environment where all machines will be designed to communicate with one another and work together in order to provide humans with useful information (Kim, 2016). Currently, although less than 1% of 'things' are connected to the internet, the proliferation of the hyper-connected revolution, in which all things are connected to the internet, will lead to the creation of diverse innovations and business opportunities in different industries in the near future. This means that the opportunities and challenges caused by the IoT may surpass our expectations. According to the Korean NIA (2014), the worldwide market for the IoT is forecast to grow from AUD 269 billion in 2013 to AUD 1.35 trillion by 2020. Korea is currently looking at this market and encouraging telecommunication companies to develop efficient technology and services, based on the 'Master Plan for IoT' drafted by the Korean government.

In 2015, Korea became one of the first countries to commercialise IoT related products and services. LG U+, which is one of the major telecommunication companies in Korea, launched the world's first IoT service called 'IoT@home' which allows homeowners to control household devices such as switches, plugs and gas valves remotely and automatically via their smartphones and media devices. After the launch of this service the market responded positively. KT and SK telecom, which are major telecommunications companies, began to compete with LG U+ by developing their own set of IoT technologies and services. In this emerging market, companies are fiercely competing to secure new subscribers by promoting their own unique services. KT has launched health oriented IoT services, SK telecom has forayed into business oriented IoT, while LG U+ has focused primarily on home oriented IoT technology. The price of their services ranges from $16.14 to $33.63 AUD while total subscribers of IoT services in Korea are expected to reach to 1 million by the end of 2016. The Korean government expects that the fierce domestic competition will likely increase Korea's global competitiveness in the production of IoT related technologies.

Figure 3. Advertisement to promote subscription of IoT service published by three major telcos: LG U+ (Left),   KT (Middle),   SK telecom (Right).

Source:
http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=101&oid=029&aid=0002365818

Source:
http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=105&oid=109&aid=0003358939

Source:
http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=105&oid=001&aid=0008780480

5G

According to previous studies (Dohler et al. 2016; Rost et al. 2016) , 5th generation (5G) is the word used to express the next generation of mobile networks beyond 4G LTE mobile networks. Theoretically, 5G is expected to show fast network speeds of 20 G/bps or higher, more than 200 times faster than existing 4G networks. 5G also has extremely low latency when transmitting large amounts of data. Under 5G, not only will people be connected to each other, but so will machines, automobiles, city infrastructure, public safety systems and more. 5G networks are also expected to have 'always-on' capabilities and be energy efficient, all of which will likely require new protocols and access technologies. Massive amount of information will be created, distributed and consumed at a level far beyond our current capacity. Society can expect to develop many new experiences by increased access and proliferation of information. Interestingly, as of mid-2016, 5G technology standards have yet to be determined, while the extent to which it will play a part in our daily lives remains unknown.

The reason that Korea has focused on 5G is just that. All things considered above, the Korean government has judged that their current ICT environment will provide them with an advantage to lead in 5G. Korea's highly advanced network, telecommunications technology, and competitive marketplace, are exemplary accomplishments in the field of ICT. As a result of venturing into 5g, Korea has developed several important international players.

Three companies have managed to develop 5G technology and stand out in a notable manner. KT, which is the official telecom partner of the 'Pyeongchang Korea 2018 Olympic Winter Games', is currently preparing 5G technologies and services for all visitors. According to KT, spectators around the world will have access to a number of services built from the nation's next-generation 5G wireless network. This will include the ability to watch an event from the

perspective of a competitor, 360-degree videos, and holographic interviews to enhance a viewer's experience, may all become standard features during the 2018 Olympic broadcast. KT considers the 'Pyeongchang 2018 Olympics' an opportunity to show the world their 5G technologies and services. See Figure 4 for example of holographic interviews and 360-degree video.

Figure 4. Example of holographic interviews (Left) and 360-degree video (Right) which will be served by KT during 'Pyeongchang 2018 Olympic Winter Games'. Source: www.kt.co.kr

SK telecom, the country's most widely used mobile carrier, aims to be the world's first operator of a 5G network. However, the company is struggling to develop 5G-related technologies and services by cooperating with several conglomerates, which are trying to use 5G technologies around the world. SK telecom's attempt to commercialise self-driving cars can be considered as an example in the continued pursuit of difficult challenges. In November 2016, SK telecom tested a technology called T5, an experimentally connected car running on a 5G trial network developed together with Ericsson. Two vehicles were each outfitted with a 5G receiver allowing them to communicate over 5G. According to SK Telecom, the trial was the world's first field test using a 5G trial network while applying 5G to a connected car traveling on the road. Based on this success, SK Telecom is anticipating to commercialise the technology in the near future. SK is looking at focusing on the development of its commercial technology and services swiftly while KT has spurred on an improvement of 5G-related source technologies independently. While SK is focusing on products and services that run on 5G networks, KT is involved in the development of the core technologies related to 5G.

Based on this research, it is clear that Korea continues to energise its ICT industry by introducing promising technologies such as 5G while creating a competitive environment for technology to thrive and flourish. The Korean government will continue to play a major role as a guide, investor, controller, and facilitator in order to achieve this goal.

Conclusions

As we have seen in the preceding discussion, the implications of Korea's achievements could be summarised by three main areas of focus.

Firstly, Korea has been able to turn crisis into opportunity, by using the recession of 1998 as momentum to reorientate its economy towards the production of advanced technologies. It is important to note that the competitive market environment in the field of ICT was driven by government policies which helped to overcome the crisis. Looking back at the recovery, we can conclude that strategic cooperation between government and industry stakeholders can create a healthy market environment allowing all stakeholders a chance to achieve success.

Secondly, although the ICT market operates according to the principles of a free market, during all stages of progress, Korea was able to carefully plan the development of its ICT industry; this was no coincidence. In order to sustain global leadership in the field of ICT, the Korean government continues to fine-tune its market environment allowing it to maintain competitiveness in the global market.

Thirdly, the key drivers, aside from the government's commitment to industry, are the many innovative private telecommunications companies which are complemented by a tech-savvy population. Spending on ICT and high-technology by consumers and producers has allowed Korea's economy to transform itself into a knowledge-based information society while moving Korea further into the 'smart-age'. It seems to be clear that Korea is preparing for the next challenges, based on the advantage gained in overcoming the crisis. Nobody can guarantee that Korea can continue to succeed. Nevertheless, the reason that we have to pay attention to Korea's challenge, regardless of the success in the upcoming future, is the implications from challenge and overcoming hardships. We have learned a lot from historical facts and we know well that the historical lessons could become the cornerstone of success.

On reflection, we've experienced a rapid change since the introduction of smart media devices, and the change continues to occur around us. The speed of change may be faster and we may be forced to accept it more actively. Time continues on, so it is imperative that we do not shy away from the opportunities this great change presents us. Perhaps the most interesting point is the unpredictability to the future and because of it, we can get a lot more than we anticipate in the field of ICT-centred telecommunication industry.

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