India and China:

A Comparative Analysis of Mobile Phones in Agriculture

By

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Submitted to the graduate degree program in Global and International Studies and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.

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Date approved: Feb 3, 2014

Abstract

In 2010, China and India were named the first and second largest mobile phone markets in the world based on their number of subscribers. India and China have focused on extending their telecommunication services into rural areas for socio-economic benefits. Both countries liberalized and privatized the industry under different political regimes utilizing different strategies. The aim of this thesis is to examine the collaborative efforts of public and private agencies in India and the role they do in disseminating information to farmers through mobile phones when compared to the government agencies in China that have been created to share that information in order to determine which program is more effective. To answer this question, the thesis compares Indian and Chinese policies and programs enacted to encourage sales and use of mobile phones in the agricultural sector to increase efficiency and encourage growth. As free market principles and private for-profit corporations are generally more efficient than government agencies, this thesis hypothesizes that the policies and development initiatives taken by the Indian government are more successful in disseminating information than the government agency approach followed by China. In response to the above research question, the thesis reveals that while the mobile phone agricultural information service programs have been successful in their respective countries, the programs in India are more reliable and faster in disseminating information to farmers. This is determined because the number of subscribers in India's mobile phone agricultural information service programs grew 37.47% in 4 years, from 2008-2012, versus subscribers to China's agricultural information service programs that grew 21.1% from 2007-2010.

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ACRONYMS

BSNL	Bharat Sanchar Nigam Limited
CDMA	Code Division Multiple Access
DoA&C	Department of Agriculture and Cooperation
DOT	Department of Telecommunication
GDP	Gross Domestic Product
GOI	Government of India
GSM	Global System for Mobile Communication
ICT	Information and Communication Technology
IFFCO	Indian Farmers Fertilizer Cooperative Limited
IKSL	IFFCO Kisan Sanchar Limited
ITU	International Telecommunication Union
MII	Ministry of Industry and Information Technology
MPT	Ministry of Posts and Telecommunications
OECD	Organization of Economic Cooperation and Development
PPP	Public Private Partnership
RIN	Rural Information Network
SMS	Short Text Messages
TRAI	Telecom Regulatory Authority of India
UNDP	United Nations Development Program
USF	Universal Service Fund
VAP	Village Phone Program
WTO	World Trade Organization

CHAPTER 1

Introduction

"*The cell phone is the single most transformative technology for development*."[1]-Jeffery Sachs

Telecommunications is one of the, if not the most, important sector for a country's economic development. Research reveals that telecommunications fosters economic development in a country, and countries that adopt and utilize Information and Communication Technologies[2] (ICTs) prosper (Hudson, 1995; OECD, 2003; Saunders, Warford, & Wellenieus, 1994; Sinha, 2005). In particular, mobile phone usage is correlated with socio-economic development and improved living standards (Abraham, 2007). According to the International Telecommunications Union (ITU), in 2010 there were 5.31 billion mobile phone subscribers globally. China contributed 8.59 million subscribers and India contributed 7.52 million subscribers to this number. China and India became the first and second largest mobile phone markets in the world, as well as the two fastest-growing mobile phone markets based on the number of subscribers. As a result, both countries are experiencing socio-economic development due to mobile phones.

The growth of the mobile phone sector in these two countries makes for an interesting comparison because both countries liberalized and privatized their telecom sectors using different strategies under different political regimes. Previous research reveals that rural citizens and farmers are empowered by the use of mobile phones and government institutions and are using the new technology to disseminate information to people in the country. Within this

[1] "Mobile phone: Weapon against global poverty," Kevin Voigt, CNN, October 9, 2011.
[2] The definition of ICT can be varied. For example, ICTs can be applied to older information technologies like broadcast radio, media, and television. But the new literature on ICT for development means it applies only to technologies based on computer, digital, and telecommunications.

context, this thesis examines whether the collaborative efforts of public and private agencies in India do a better job in disseminating information to farmers through mobile phones compared to government agencies in China. To answer this question, the thesis compares Indian and Chinese policies and programs enacted to encourage sales and use of mobile phones in the agricultural sector in order to increase efficiency and encourage growth.

In the agricultural sector, farmers need reliable and accurate information for good agricultural production. Mobile phones have become the new technology to communicate information. Benefits from this information include the following:

- Weather information: Assists farmers with pest and disease control efforts that may greatly reduce losses.
- Market information: Helps farmers determine the best time to buy and sell fertilizers, seeds, and crops.
- Communication in the field: Helps families and workers stay connected.

Effective mobile phone-based programs focusing specifically on agriculture and production can help achieve these benefits. In an age where communication is key and information is power, corporations and governments have focused on fostering and promoting the use of ICTs to enhance agricultural development. This thesis will compare the public-private cooperation strategy pursued by the Indian government with the government agencies approach followed in China. In the case of India, the Indian Farmers Fertilizer Cooperative Limited Kisan Sanchar Ltd. Program (IFFCO-IKSL) is an important group to use as a comparison because of the public-private partnership that characterizes the program and government policies of that country. In the case of China, China Mobile Ltd.'s Rural Information Network (RIN) program is included in the comparison as this program is the only one available in most areas of China and has been designed and implemented by government agencies.

Under different political regimes with such diverse changes to the telecom industry implemented by both the countries; the research question to consider is if the collaborative efforts of public and private agencies in India and the role they do in disseminating information to farmers through mobile phones do a better job when compared to the government agencies in China that have been created to share that information. As free market principles and private for-profit corporations are generally more efficient than government agencies, this thesis hypothesizes that the policies and development initiatives followed by the Indian government are more successful in disseminating information than the government agency approach followed by China.

Both primary and secondary sources of data were collected and reviewed. The primary sources of data describing the telecom policies for each country came from their country's government and regulatory websites. Information on India's IFFCO-IKSL Program and China's RIN Program were acquired from company websites, study papers, and news reports. The IFFCO-IKSL programs statistics and survey material are drawn from *mAgri Programme Case Study – IKSL,* studies by Global System Mobile Communications (GSMA), and a report on India, *The Impact of Mobile Phones*, commissioned by Vodafone, a mobile service provider company. The RIN program strategy and benefits is drawn from a case study called China Mobile's *Rural Communications Strategy* produced by Harvard Business School, in addition to China Mobile's sustainability reports for the years 2009 and 2010. Statistics on the mobile phone industries and the Indian and Chinese economies were obtained from the World Trade Organization (WTO), Organization of Economic Co-operation and Development (OECD), International Telecommunications Union (ITU), Food and Agricultural Organization of United Nations (FAO), United Nations Development Program (UNDP), the Government of India (GOI),

National Bureau of Statistics of China, and the China Data Online database. Scholarly articles, archival sources, and business journal and news reports were collected as secondary sources. The next section of the chapter provides the background information on India and China and the thesis organization.

Background

India and China provide an inevitable pair for comparison in academia, news, and business. As Almond, Powell, Strom, and Dalton (2004) say, "Comparative analysis helps us develop explanations and test theories of the ways in which political processes work and in which political change occurs" (p.31). This section provides a brief comparison of India and China's demographics, politics, economy, agriculture, and telecommunications industries. The comparison helps to foster a better understanding of the different processes undertaken in their respective political systems and assists the reader to understand better the challenges faced by each country.

India and China are the two oldest civilizations that share a border on the Asian continent and also the largest countries in the world in terms of population size. Combined, India and China account for a third of the world's population. However, their demographics are very different. Table 1 provides details of the comparison.

Table 1

Basic Indicators in the Year 2011

Indicator	**India**	**China**
Landmass	3.2 million square kilometers	9.6 million square kilometers
Population	1.24 billion	1.34 billion
% of Rural population	60%	52%
Gross Domestic Product (GDP) real growth rate	7.8%	9.2%

Population growth rate	1.31%	0.48%
GDP per capita	$3,700	$8,400
Median age	26.2 years	35.5 years
Population below poverty	25%	13.4%
Literacy rate (15 years and up that can read and write)	62.8%	94%
School life expectancy (primary to tertiary education)	10 years	12 years
Human Development Index (HDI)	0.55 (134 of 187 countries)	0.68 (101 of 187 countries)
GDP composition by sector	agriculture: 18.1%; industry: 26.3%; services: 55.6 %	agriculture: 10.1%; industry: 46.8%; services:43.1%
Public expenditure on education (% of GDP)	3.1%	2.5%
Labor by occupation	agriculture: 53%; industry: 19%; services: 28%	agriculture: 34.8%; industry: 29.5%; services: 35.7%

Adapted from: UNDP 2011 report, CIA World Fact Book, and World Bank 2011 indicators

Although migration to urban centers continues in India and China, basic indicators reveal that the majority of the population in both countries lives in rural areas. Due to the vast populations of both countries, agriculture will always be an important sector despite the fact that other sectors drive their economic growth. Several indicators such as HDI, poverty rate, literacy rate, and GDP place China ahead of India. However, China's population growth rate of 0.48% is lower than India's growth rate of 1.31%. China's population growth rate is stagnant due to the "One-Child" policy, whereas India's population and labor force continues to grow at a faster rate, creating a much larger percentage of young workers (median age is 26.5 years)[3]. In terms of telecommunications, China and India are closely ranked. Although China currently leads in terms of the number of mobile phone subscribers, it may be argued that India may soon surpass China because of India's population growth rate.

[3] According to Population Reference Bureau, India's population is set to overtake China by 2050. <http://news.bbc.co.uk/2/hi/3575994.stm>

Political and economic environment. Following India's independence in 1947, under the leadership of Jawaharlal Nehru, India chose a mixed economic model that combined socialist policies from the Soviet Union with Western capitalism. India implemented protectionist policies, followed an import-substitution industrialization approach, and regularly engaged in public sector and government intervention. Such an approach produced limited development and growth. In early 1991, the balance of payments crisis forced India to expand its markets to global investors. The government started to liberalize and open the economy up to foreign investment and trade. Unlike China where the agricultural sector saw the first reforms, India started its reforms in its industrial sector. Later, the Indian government brought reforms to the agricultural sector following the economic success it had in the industrial sector.

Under Mao Zedong, China adopted strategies to build a modern industrial sector that included eliminating property owners and private entrepreneurs. Movement and migration within the country was forbidden. The approach did not promote development or result in economic growth. In December 1978, still under the rule of the Chinese Communist Party, China gradually opened its economy to foreign investment. According to Manion, Deng Xiaoping, China's "paramount leader," introduced political and economic reforms throughout the country (as cited in Almond, Powell, Strom, & Dalton, 2004). These reforms were first seen in the agricultural sector and then slowly in other industries. The economic growth opened opportunities for private enterprise. In 1980, the state enterprises held 80% of the industrial production, but by 2000, only 25% were state enterprises (Almond, Powell, Strom, & Dalton, 2004). The shift in the ownership of the enterprises from state to private is due more to "collective enterprises," with ownership by local community at the township and village level in which the local government

played an important role in the management of the enterprise (Almond, Powell, Strom, & Dalton, 2004).

Though reforms were started under different conditions and in different years, both India and China saw dramatic economic growth in a span of a decade. According to the Central Intelligence Agency (2010), India and China are the eleventh and second largest economies in the world based on 2010 GDP figures.

Figure 1 shows the five-year average annual GDP growth rates of India and China. The averages clearly indicate that India lagged behind China until 2001, which was because of its late liberalization. Between 2007 and 2010, India caught up to China's 8.4% annual growth rate, recording an average annual growth rate of 8.02%. India's economic boom is primarily from its service sector, whereas China's growth originates from its manufacturing sector. Both countries, however, have been an attractive destination for FDI due to their large populations and growing middle class.

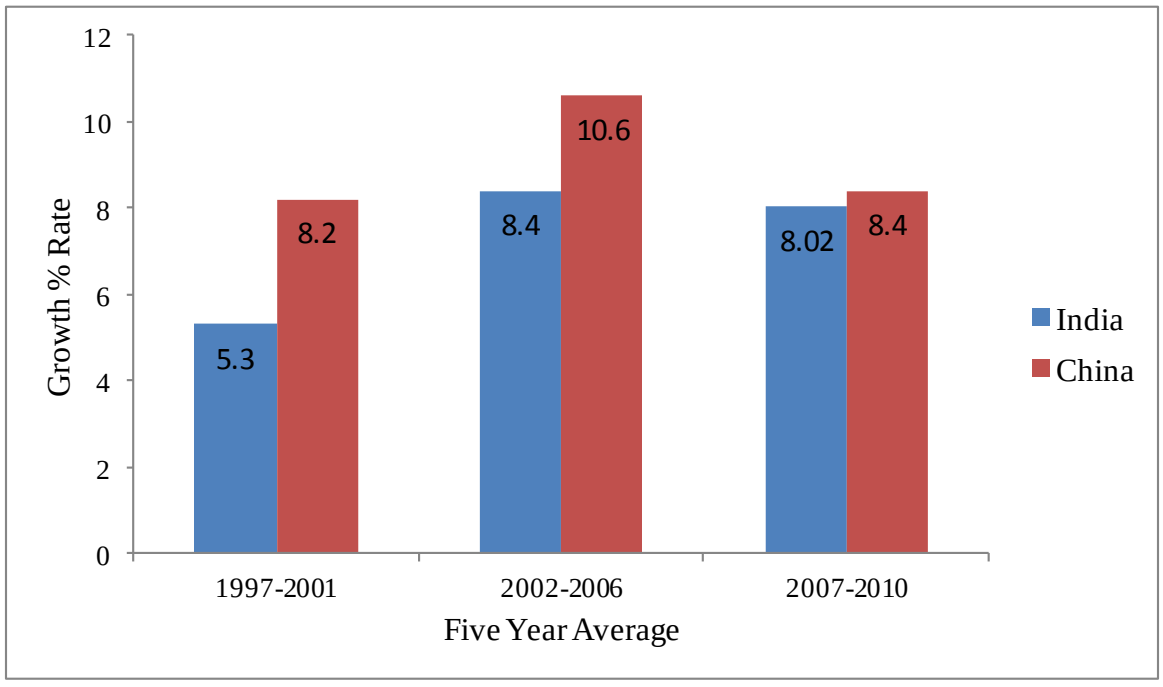
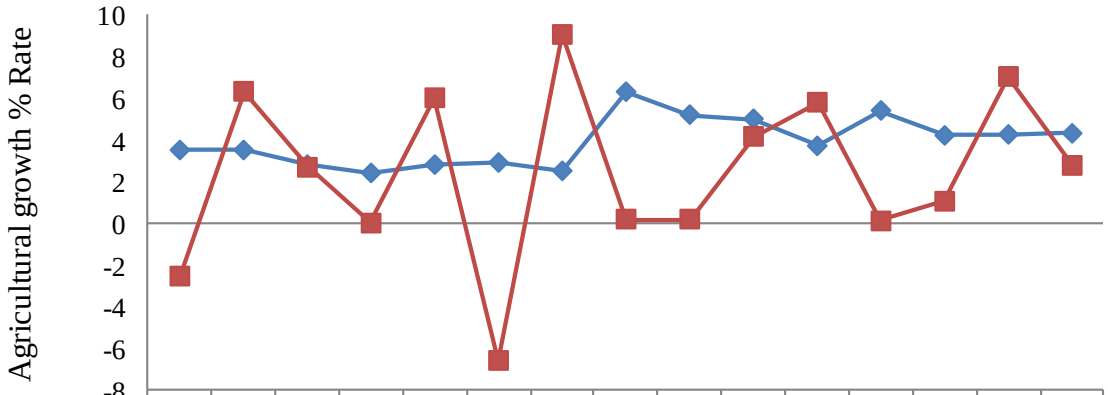


Figure 1. Average of Annual Percentage Growth Rate of GDP. The graph illustrates the

comparison of India and China's GDP growth rate after liberalization. Data obtained from World Development Indicators, World Bank & CIA World Fact Book.

In recent years, agricultural production as a percentage of GDP has decreased considerably in both India and China. Although India and China differ in their social, political, and economic environments, a large percentage of the population in each country is employed and makes their living in agriculture. The agricultural sector in both countries is vitally important.

Agricultural sector. Agriculture is a key sector for India and China. Table 1 indicates that 53% of India's population and 34.8% of China's population list agriculture as their main source of income. Both nations share similar agriculture concerns, such as feeding a large population, a history of famines, and food security. In order to increase the agricultural output, both nations made significant reforms in their agricultural fields. The adoption land reform policies, the use of high yield seeds, fertilizers and modern irrigation system led to sustained growth in agricultural sector in both countries.



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
China	3.5	3.5	2.8	2.4	2.8	2.9	2.5	6.3	5.2	5	3.7	5.4	4.2	4.25	4.3
India	-2.55	6.32	2.67	-0.01	6.01	-6.60	9.05	0.18	0.18	4.16	5.80	0.09	1.04	7.03	2.76

Figure 2. Agricultural Percentage Growth Rate from 1997-2011. Graphic shows that China has a steady agricultural growth rate in China and India's growth rate. From Data World Development Indicators, World Bank.

Figure 2 shows the agricultural growth rate in India and China over a period of 15 years. It can be seen that China's agricultural growth rate has been consistent through the years, whereas India's growth rates fluctuated throughout the years. One of the reason's China outperformed India in agricultural production is in research and development. China's central government invested a $1.5billion in agricultural research in 2006 (Aiyar, 2007). In addition, India, mainly supports farmers through high subsidies for fertilizers or electric power rather than in investing directly in agricultural investment (Aiyar, 2007). Second, China's central government maintained price controls on important crops like wheat, soybeans, and corn (Fang, Tuan, & Zhong, n.d). Third, India did not continue to the use of high yield crops as much as China.

However, both countries have the drastic the agricultural output they converge on one point. Both countries are in need to improve agricultural production to feed their growing population and to eradicate poverty. Both nations have started incorporating and implementing 21st century telecommunication technologies that can increase productivity and efficiency in the field of agriculture.

Telecommunications growth. Telecommunications has played an important role in the economic development of India and China. However, one interesting factor to compare and study in these countries is that although both are similar in many ways, they have implemented different strategies under different political regimes in order to develop their telecom industries. China has an authoritarian regime but continues to liberalize and deregulate its telecommunications industry. India continues to liberalize its economy yet privatize its telecommunications industry under a democratic regime. As a result of the reforms implemented, both countries have experienced a dramatic growth in their mobile telephone sectors.

Table 2 provides a comparison of landline and mobile phone growth in India and China.

Table 2

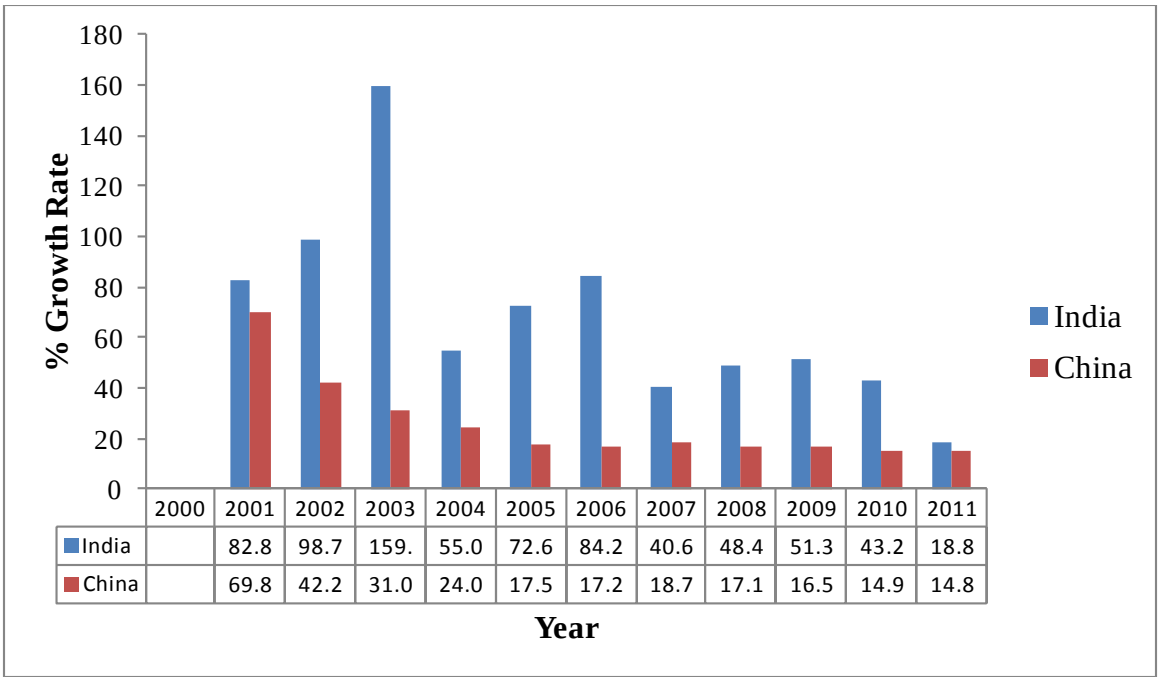
Fixed Line and Mobile Phone Subscribers(in thousands) from 2000 to 2011

	CHINA		**INDIA**	
Year	**Fixed-Line**	**Mobile Phone**	**Fixed-Line**	**Mobile Phone**
2000	145	85	32	4
2001	180	145	39	7
2002	214	206	41	13
2003	263	270	42	34
2004	312	335	46	52
2005	350	393	50	90
2006	368	461	41	166
2007	366	547	39	234
2008	340	641	38	347
2009	314	747	37	525
2010	294	859	35	752
2011	285	986	33	894

Adapted from Fixed Line and Mobile-Cellular Subscriptions as of 2011, ITU.

India and China have experienced steady growth in fixed line and mobile cellular lines since 2000. Based on Table 2, the fixed lines steadily increased in China until 2007 and in India until 2006. The number of fixed line subscribers in both countries started to decrease after 2006, which is the same time mobile phone subscribers increased.

Figure 3 shows the comparison of mobile phone subscribers' growth rate in both countries.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
India		82.8	98.7	159.	55.0	72.6	84.2	40.6	48.4	51.3	43.2	18.8
China		69.8	42.2	31.0	24.0	17.5	17.2	18.7	17.1	16.5	14.9	14.8

Figure 3. Comparison of Mobile Phone Subscribers' Growth Rate from 2000-2011. The graph illustrates India and China mobile phone user's growth rates. India has a steady higher rate. Data obtained from Mobile-Cellular Subscriptions as of 2011, ITU.

Table 2 indicates that India's mobile phone subscribers' base was behind China's. But when viewing it from a year to year growth rate perspective, India shows it has been constantly growing at a higher rate compared to China (see Figure 3). The factors contributing to the rapid growth of the Indian and Chinese telecommunications sectors are discussed in Chapter 3.

Overview of Chapters

The next chapters of the thesis are organized as follows. Chapter 2 provides a review of the literature and is divided into three sections. The first section investigates the use of mobile phones in rural regions and their impact on peoples' lives. The second section discusses the theory of neo-liberalism in the context of telecommunications, and the third section reviews the policies to bridge the urban-rural communication gap.

Chapter 3 provides an overview of the telecommunications sectors in India and China and is divided into four sections. The first section looks at the telecom sectors in India and China before liberalization. The second section reviews the liberalization and privatization process of India's telecom sector. The third section looks at the liberalization of China's telecom sector. The last section provides both a comparison table of India and China's current telecom operators and owners and a conclusion regarding their different liberalization process.

Chapter 4 reviews the various mobile phone policies implemented to promote rural development and agricultural productivity in India and is divided into two sections. The first section looks national policies and strategies used in agriculture through ICTs. The second section specifically studies the impact of mobile phones on the lives of farmers under the IFFCO Sanchar Ltd program designed and implemented under a public-private partnership.

Chapter 5 provides the policies and strategies implemented by China in the field of agriculture through ICTs. The chapter explains their village phone project that is implemented to provide access to all villages. In addition, the chapter studies China Mobile Group's RIN program put into operation by organizing village government agencies to narrow the digital divide between urban and rural areas.

Chapter 6 compares and examines India's IFFCO Sanchar Ltd Program and China Mobile's RIN program to determine if agriculture production increased in each country and if the programs in India and China met the needs of each country's farmers. The success of the programs is measured by the increase in the volume of subscribers in each program. The chapter also includes final remarks and several statements about the significance and limitations of the study.

CHAPTER 2

Review of Literature

This chapter reviews the academic studies related to the following aspects of India and China's telecommunications sectors: the socioeconomic impact of mobile phones on the lives of rural citizens, the theory of neoliberalism in telecommunications, and the policies adopted to bridge the digital divide between urban and rural areas. This literature review looks at telecom policies overall, as the mobile communications fall under the telecommunications industry, but it limits the discussion to mobile phones and rural development.

Mobile Phones: Impacting Lives in Rural Regions

Technology leapfrogging refers to the process of adopting advanced technologies by skipping over prior technology or product cycle phases and adopting the technologies designed by industrialized countries without incurring the cost of development (Singh, 1999). Technology leapfrogging allows developing countries to use mobile phones as a source for socioeconomic development in rural areas. Jaffee (1998) defines socio-economic development as "the ability to produce an adequate and growing supply of goods and services productively and efficiently, to accumulate capital, and to distribute the fruits of production in a relatively equitable manner" (p.3). Recent literature focuses on the use of mobile phones and their impact on socio-economic development. It questions whether mobile phones contributed to the improvement of one's life. This section will review the impact of mobile phones in rural regions.

Studies look at how the use of mobile phones has improved the welfare of consumers, farmers, and small businesses (Abraham, 2007; Aker, 2008; Jensen, 2007). Jensen (2007) studied the impact of mobile phones on the fisheries sector in Kerala, India. Based on micro-level survey data and using the Law of One Price economic theory, he found that information provided

through mobile phones contributed to a dramatic decrease in waste and price variations in the fishing system. As a result, fishermen's profits increased by about 10%. Similarly, Abraham (2007) studied the correlation between ICTs and economic development in fishing industry in Kerala, India. He considered mobile phones, as a means of reducing information asymmetries in markets, which in turn would increase the efficiency of rural markets. He found that the fishermen's using mobile phones were able to reduce their risks associated with uncertainties of the market. Frequent communication and messaging about weather conditions and traffic helped to improve the quality of life of fishermen's and drivers. By increasing access to information and decreasing the isolation of fishermen's, the chances of unexpected weather or road emergencies decreased.

Similarly, in Niger, the majority of the population depends on agriculture as the primary source of income. Aker (2008) provides evidence that cell phone usage increased reservation sale prices for grain traders, and that an increase in the number of markets led to a decrease in price dispersion across markets. Reservation sale price in microeconomics is the maximum and minimum price paid by buyer and seller for a product. Price dispersion is a phenomenon that occurs when there is a difference in sellers and market price for the same product. This research uses a Sequential Search theoretic model that focuses on search costs from the trader and consumer's perspective. The dataset was collected between 2005 and 2007 and includes grain prices, transport costs, agriculture production and rainfall, cell phone coverage, road quality, and trade flows. The data also includes a survey of farmers, traders, transporters, and market resources (Aker, 2008). Overall, access to information through mobile phones improved quality of life for consumers and traders. As grain markets are held only once a week, traders had reduced trade costs, as they were able to use cell phones to obtain information on supply,

demand, and prices of grains rather than travelling long distances to markets to find information. The difference of cell phone costs (US $2) in searching for information on prices versus the traditional travel costs to the markets (US $20) has helped traders and consumers to save more money and improve their quality of life (Aker, 2008).

Previous studies showed that mobile phones have improved the economic welfare of rural citizens. Other studies look at the impact of mobile phones on social welfare (Wei & Zhang, 2008; Yang 2008). Wei and Zhang's (2008) case study based on Diffusion of Innovation and Perceived Need theories analyzed the psychological and behavioral factors as well as the demographics associated with the adoption and use of mobile phones in Hubei, a rural region in China. The three psychological factors considered are the Perceived Characteristics of Mobile Phones (PCM), the Perceived Popularity of Mobile Phone (PPM), and the Perceived Need for Mobile Phone (PNM). The behavioral factors considered are mass media use, interpersonal communication, and adoption of similar new media technologies. The two dimensions of mass media use are time and content. Interpersonal communication means the frequency of communicating with family and friends. Adoption of similar new media technologies is a new media technology that perceived needs such as immediate access, instrumentality, fashion and statues, affection and sociability, and relaxation (Wei & Zhang, 2008). The demographic variables included in the study are age, gender, education, family income, marriage status, and occupation; in combination, these factors help to explain people's attitudes about mobile phones as well as their adoption patterns (Wei & Zhang, 2008,).

The case study data conducted by Wei and Zhang (2008) on adoption, use, and perceived needs of mobile phones used interviews and questionnaires from three villages in three counties in Hubei Province in August 2005. The authors found a rapid increase in the adoption of mobile

phones from 2004 to 2005 (31.2% to 59.6%) in rural China (Wei & Zhang, 2008). Their research reveals that psychological factors matter less in mobile phone adoption among rural citizens than behavioral factors. It also found that as rural residents have lower incomes than urban residents, socio-economic and living conditions are more influential than perception and feelings in explaining the adoption patterns and usage of mobile phones (Wei & Zhang, 2008, p.182). The study concludes that immediate access, instrumentality, and interpersonal communication are the main factors that help explain adoption and usage patterns of mobile phones.

Yang (2008) studied the impact of mobile phones on the social lives of migrant workers in Beijing through interviews combined with quantitative data. Though the study is not specific to rural regions, the individuals included in the study are semiskilled or unskilled workers who moved to the city with the hope of improving their socio-economic status. He concludes that the use of mobile phones helped the workers to maintain a "feigned presence" and connects them to family and friends in rural regions. The use of mobile phones improved the social links between the workers and their family and friends living in rural regions (Yang, 2008). Case studies and research on government policies and choices to stimulate growth in the telecommunications sector follow in the next section.

Government Intervention and Telecom Growth

Proponents of neoliberal economic policies claim that reducing the government's role in basic telecom services and deregulating state-owned enterprises increases competition that in turn will encourage growth in the telecom industry specifically and the economy generally (Noll, 2002). Many countries in the West have adopted such policies in the telecom sector. In 1980, the United States government broke up AT&T's monopoly and allowed competition (Wallsten, 2006). These policies eventually spread to developing countries in the 1990s. Since

then, there have been multiple cross-national case studies explaining developing countries' telecom industry growth due to the adaptation of neoliberal policies (OECD 2003; Petrazzini & Krishnaswamy, 1998; Wallsten, 2001; Wauschkuhn, 2001).

Several of the cross-national studies include India and China in their comparisons. Harwit (1998) took a comparative developmental approach by comparing China's policy process and telecom investment to other nations. Petrazzini and Krishnaswamy (1998) compare the restructuring of the telecom industries in Latin America with the restructuring efforts in Asian countries. Individual case studies of India and China conclude that the adoption of neoliberal policies have helped to reform the telecom sectors in both countries and have contributed to the overall economic growth of each country over the past decade. Both countries promoted competition and fostered foreign investment in telecom networks and basic services after reforms. However, India is the only country that allowed foreign investment in basic telephone services and private firm entry. In addition, the governments gave foreign investors preferential state loans, decreased service charges, and decreased handset prices. Such actions resulted in an increase in the growth of product sales and services in the telecommunications sectors. The overall telecom and cell phone penetration (access to mobile phones) rates also increased (Harwit, 1998; Kathuria, Singh, & Soni, 2000; OECD, 2003; Petrazzini & Krishnaswamy, 1998).

In order to implement these neoliberal policies, governments must play a critical role, especially in the rapidly changing technological world (Harwit 1998; Lu & Weber, 2007; Seo, 2010). The Chinese government played a critical role by making a conscious effort to develop a telecom infrastructure and to provide nationwide telecom services through policy changes (Harwit, 1998). Harwit (1998) argues that China's policies and strategies based on "market socialism," such as the fifteen-year plan in 1984; the "Three 90 percent" strategy in 1989; and

the structural reorganization of the telecom industry in 1990 that decentralized the national monopoly all contributed to the increases in the number of telephones in China[4]. The argument is based on a comparative developmental approach that looks at policy process and patterns adopted in developing countries such as China, India, Kenya, Mexico, and Argentina that share similar economic conditions. Harwit concludes that China's socialist approach to develop and expand their telecom industry contributed significantly to economic growth. Instrumental to this success were policies to increase foreign investment in telecom networks, improve rural access to communication, and decentralize the state monopoly (Harwit, 1998).

A recent study by Lu and Weber (2007) argues that the Chinese government played a powerful role in maximizing the economic benefits of the mobile communication sector. To minimize threats to political, economic and social stability and maximize mobile phone growth in a socialist market economy, Chinese authorities used the logic of "controlled commodification"[5], transformational and symbolic power (Lu & Weber, 2007, p. 926). Transformational power is defined as "the power to transform information or materials through multiple interdependencies such as regulatory bodies and non-state entities" (Lu & Weber, 2007, p. 930). Symbolic power is defined as "the power to present traditional values and healthy social norms as an alternative to corrupt individual moral practices or the power over thoughts and perceptions" (Lu & Weber, 2007, pp. 929-937). These strategies contributed to the development of the telecom industry by introducing market reforms while reinforcing the government's power through its authoritative leadership role.

India's government also played a critical role in the development of its telecoms industry. Liberalization of local loop, which means allowing private owners to compete with national

[4] See Harwit (1998) pages 184 and 185 for explanation of these strategies.
[5] See Lu & Weber (2007) page 926 for further explanation on the logic.

carriers instead of privatizing the state-owned carriers, permits multiple telecom operators to use the telecommunication exchange to the customer's premise. India's strategies such as forming telecom circles based on regions to provide local services, liberalizing local loops, creating the Telecom Regulatory Authority of India (TRAI) (an autonomous telecom regulatory body), and allowing private corporations to compete with national carriers to provide local services helped to encourage growth in India's telecom industry (Petrazzini & Krishnaswamy, 1998). To support the rapid growth of India's service sector, the government realized the need and importance of telecom infrastructure for accessing information and appropriately played a critical role in the development of India's telecom industries and infrastructure (Kathuria, Singh, & Soni, 2003).

Bridging the Urban -Rural Communication Divide

OECD defines Digital Divide as "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access ICTs and their use of the Internet for a wide variety of activities. The digital divide reflects various differences among and within countries" (OECD, 2006, Para definition of digital divide). For the purpose of this thesis, the definition is extended to include advanced technologies like mobile phones.

Dasgupta, Lall, and Wheeler's (2001) research provides anecdotal and empirical evidence of internet use in developing countries. Measuring internet use extends to mobile telephones, as new technologies rapidly overtake computer-based internet access. Dasgupta, Lall, and Wheeler (2001) compared Asian, Latin American, and African countries' mobile phone growth during the 1990-1999 period and concluded that growth was a result of boosting competition and increasing private investment. The empirical data compares the impact of mobile phone growth to income growth, urbanization, and competitive policy. The study concludes that "though income remains

a prime determinant of the digital divide; results suggest that appropriate economic and competition policies can sharply narrow the gap" (Dasgupta, Lall, & Wheeler, 2001, p.10).

Adoption of advanced technologies in the telecom industry promotes private investment and competition and brings technological innovation along with lowering prices to consumers. The OECD (2004) remarks upon this phenomenon when it writes, "the introduction of competition to markets has a profound effect on telecommunications penetration rates, even when the competition comes via a different technology" (p.18). The OECD (2004) also contends that India and China have effectively introduced competition in their respective mobile markets. In the case of India, deregulating mobile services such as SMS and VOIP, promoting technology neutrality, allowing unified licensing, and moving from a Receiving-Party-Pays system to a Calling-Party-Pays structure has increased mobile phone market growth. In the case of China, dividing fixed and mobile markets has increased competition, and as a result, increased mobile phone access.

Countering this viewpoint, critics argue that mere competition and private investment does not foster mobile penetration. Other factors such as fees, the private investor's role during policy changes, and governance in implementation of the policies are also important (Jain & Raghuram, 2010; Kumar & Thomas, 2006). Kumar and Thomas (2006) agree that India opened its mobile market to foreign investment by increasing the foreign direct investment limit from 49% in 1994 to 74% by 2005, which increased competition. Foreign telecom operators and foreign equipment providers operated 74% of telecom markets. However, private investor contributions to increase the number of mobile phones in villages remained low due to high license fees and unreasonable tariffs. Because of high fees, public sector operators like Bharat Sanchar Nigam Limited (BSNL) in India or China Telecom operate in villages without

competition. Due to the lack of competition in the public sector, more than a third of the villages in India and China are yet to be covered (Kumar & Thomas, 2006).

Conclusions from the Literature

Reviewing the literature provides evidence that policy initiatives and government strategies targeting the telecommunications industries in India and China have influenced the growth in the number of mobile phone subscribers in both countries. Studies reveal a positive correlation between an increase in the number of mobile phones and improved social and economic conditions in rural areas. Most of the research is based on economic theories and field studies. Studies focused primarily on the use of mobile phones or the growth in the number of mobile phone subscribers because of policy changes. For instance, the studies by Jensen (2007) and Abraham (2007) looked at the impact of mobile phones on socio-economic development but did not consider the policy changes by the government that encouraged growth in the mobile phone sector. While the study by Kumar and Thomas (2006) is a political economic analysis of the dramatic growth of the mobile phone industries in India and China, it does not look at their socio-economic impact.

Existing research on telecom policies focused on increasing mobile growth in both countries do not completely explain the current policies initiated through telecom for rural development. There is a need add to the existing research on the policy initiatives taken by both countries by comparing the outcomes of private and public efforts to bring the benefits of mobile phones to rural regions especially to agricultural sector. Hence, this thesis is an attempt to fill this gap by examining the programs and policy initiatives implemented by the Indian and Chinese governments to increase the number of mobile phones and their usage in the agricultural sector.

CHAPTER 3

India and China: Telecommunication Sector

The telecommunications sector of any country is a potential asset for its political and economic systems. In general, improvements and reforms to the telecommunications sectors fall into six categories: (a) privatization with full competition, (b) corporatization, (c) deregulation, (d) liberalization without privatization, (e) private sector participation without privatization, and (f) liberalization (Pisciotta, 1997; Ure, 2008). According to Ure (2008), the type and extent of these reforms depend on a country's political environment. Under different political regimes, China and India implemented reforms in diverse ways. This chapter will compare and contrast the telecommunication reforms of India and China by looking at the six categories of telecom reform. In addition, this chapter will demonstrate how both countries introduced competition into the mobile sector through reforms, which was the stepping-stone towards successful growth in the mobile phone sector that has led to socio-economic benefits in agriculture and other industries.

Telecom Sector before Liberalization in India and China

Before liberalization, the Indian and Chinese telecom sectors were highly regulated, state-owned monopolies. In both countries, the telecom sector was combined with the telegraph and postal services provided by the government. In India, the Department of Posts and Telegraphs operating under the Ministry of Communications provided the telecom services. In China, the Ministry of Posts and Telecommunications (MPT) provided the services. Prior to initiating the liberalization process, India and China made several changes to their telecom industry.

India reorganized the Department of Posts and Telegraph by dividing telecom and postal services. In 1985, it created the Department of Telecommunications (DOT). Reluctant to give up control of the country's telecom services, the GOI took advantage of technology advancements and international developments in the 1980s and upgraded the industry (Gupta, 2002). Eventually, the DOT, still controlled by the government, was given the power to provide local and long distance services. Corporatization of India's telecom sector resulted in the creation of two public sector corporations: Mahanagar Telephone Nigam and Videsh Sanchar Nigam Limited. Both companies, controlled by state, were formed to provide local services in major cities and international services. Thus, India corporatized its telecom sector by creating a new institution specific to telecom services.

In the case of China, the government opened the network equipment market to foreign investment before allowing foreigners into basic telecom services. In contrast to India, China did not separate the telecom sector from postal services until the liberalization of the entire sector. However, similar to the DOT, the MPT controlled and provided the telecom services. Lu and Wong (2003) study found that "the state–owned telecom sector was placed under a rigid, semi-military administrative structure" (p.20). Until 1993, China Telecom was the only operating company under MPT that provided telecom services.

The growing demand for technological services along with international pressure were two common forces that led to the restructuring and liberalization of basic telecom services in India and China (Gupta, 2002; Loo, 2004). Upon seeing the benefits of foreign investment in China's telecom equipment sector, Indian policy makers were motivated to open their telecom industry to outside investors (Dossani, 2002). India and China both realized the benefits of opening their markets to foreign investment in telecom and started to liberalize their sectors.

Telecom Liberalization in India

India liberalized and introduced partial privatization and foreign investment in its telecom sector in 1994. Along with liberalizing the telecom sector, India announced a National Telecom Policy (NTP'94). The main objectives of the NTP'94 were to accomplish the following:[6]

- Provide telephone services to all Indians.
- Provide all villages with telephone coverage by 1997 through Universal Service.
- Improve quality of services to meet world standards.
- Become a major exporter of telecom equipment.
- Protect the defense and security interests of the country.

("National Telecom Policy 1994," n.d., Section on "Objectives")

Thus, the aim of the policy was to provide basic services to all and to improve quality, both of which were lacking before liberalization. The first two objectives were ambitious and difficult to attain. In an attempt to meet the first two goals, telecom policymakers believed that allowing competition was a way to achieve the policy goals. To increase competition, India opened and allowed private operators to offer both fixed and mobile services across the nation. As a result, private operators account for 43% of India's telecom services revenues (Kumar & Thomas, 2006). For the first time, multiple telecom corporations could compete to provide fixed-line, local mobile services (mainly Value Added Services like text messaging), paging, and satellite services under the new NTP'94 policy.

The GOI divided the country into 20 telecommunication circles for fixed-line services and 18 circles for mobile services. In addition, the circles were further divided into A, B, and C categories based on the revenue demand from each circle. The GOI allowed open mobile

[6] For complete list of objectives and aims of the policy, refer to National Telecom Policy, 1994, trai.gov.

services operation centers in four large cities (Delhi, Mumbai, Kolkata, and Chennai), as private consumption had been successful. The GOI designated two cellular licenses for each city (Kathuria, Singh, & Soni, 2002). In sum, the NTP'94 policy improved the tele-density to 9.11% (fixed line and mobile services) as of 2005 from pre-reform growth, which was 1.92% during the years 1948-1998 (Study Paper No.2, 2005). The policy benefits included allowing private providers to reduce fees and providing consumers with the ability to receive mobile services more quickly.

However, the policy also had drawbacks. Private entities were awarded mobile services licenses through a bidding process based on an arbitrary decision by the DOT. Along with DOT companies, only one private Indian company per circle provided mobile services. Foreign participation was permitted only through joint ventures with a 49% Indian stake in the companies (Ure, 2008). The DOT remained the regulator, policymaker, and competitor to private entities. State-owned enterprises did not truly privatize, and they remained dominant in the telecom industry by providing services nationwide.

Formation of independent regulatory agency. The lack of transparency in the DOT policy-making and inconsistent quality of services provided to telecom consumers led to the creation of a new, independent regulatory telecom agency. In 1997, Parliament passed the TRAI Act in order to regulate telecom services and thus created the Telecom Regulatory Authority of India (TRAI). This section focuses on how influential the TRAI has been as an independent regulatory agency, while it assumes that based on institutional theory, independent institutions will play and make decisions according to the rules of the game.

The TRAI had the responsibility to protect telecom customers and ensure that operators provide quality service and comply with the terms and conditions of the Act (S.11, TRAI ACT

1997). The TRAI also was vested with the power to publicize local and international rates for telecommunications services, to notify different rates provided to different persons or classes of persons for similar telecommunication services, and to conduct investigations of service providers (S.12, TRAI ACT 1997). In all, TRAI received substantial power and autonomy to protect consumers and ensure telecom sector growth.

Commitment to the WTO and new telecom policy. During negotiations with the WTO to provide basic telecommunications services under the General Agreement on Trade and Services (GATS), India committed to opening its market to allow for greater competition among entities providing national long distance services to Indian consumers (TRAI, DLD1, 2002). Due to both the boom in information technology and the failure to achieve the target to provide telephones to all villages by 1997 under NTP'94 policy, India needed to improve its telecom infrastructure. In order to do this, India had to move the liberalization process forward, and it did so by introducing a new telecom policy in 1999. Several of the important objectives of the policy are as follows:

- Provide universal service to previously uncovered area and rural areas.
- Ensure competition in rural and urban areas by providing equal opportunities and a level playing field for all players. Develop a modern telecom infrastructure in remote, hilly, and tribal areas to accommodate the demand for information technology.
- Provide government and community systems data base information and ISDN services in public teleinfo centers.
- Achieve efficiency and transparency in spectrum management.
- Attain an overall 15% tele-density rate, with a 4% increase in rural coverage by 2010.
- Commitment to restructure DOT.

("New Telecom Policy 1999," n.d.)

In addition to the goals and objectives above, the new policy framework included significant changes to the telecom service sector. This legislation allows all cellular service providers to provide mobile services and carry their own long distance traffic within their service area without additional licenses. Additionally, the national long distance service sector opened to private operators in January 1, 2000, and it allowed unlimited entry of private operators ("New Telecom Policy 1999," n.d.). The opening up of the national long distance sector and allowing mobile operators to carry long distance services has resulted in increased competition and reduced tariff rates.[7]

Increasing competition further. In 2003, the TRAI recommended that the GOI consider shifting from a service-specific licensing regime to a Unified Licensing Access regime. Under the new regime, telecom providers are allowed to offer both fixed-line and mobile phone services. This process was to be done in two stages. In the first stage, the fixed-line and mobile phone services would migrate to one service, and in the second stage, a process to define the guidelines and rules would be created for the fully Unified License/Authorization Regime. The GOI accepted the recommendations, and the Unified Licensing Access regime formed in November 2003. In the Unified Access licensing regime, both fixed-line and mobile phone service providers are free to offer one or both services using any type of technology under one license by paying an additional entry fee ("Recommendations on growth," 2005). This new regime opened competition by giving providers the flexibility to choose the technology they want to offer and thus increasing telecom access.

Table 3 provides details on telecom operators and their wireless market share in 2011.

[7] "The National Long Distance tariff for carrying services above 1000Kms in 2000 was reduced from US$0.67/minute to US$0.02/minute in 2009. Also, the mobile tariff for local calls has reduced from US$0.36/minute in 1999 to US$.04/minute in 2009" (India Telecom Sector, DOT.) <http://www.dot.gov.in/osp/Brochure/Brochure.htm>

Table 3

Telecom Operators in India

Operator	Year Founded	Services	Operating in	Ownership	No. of Subscribers (millions)	Wireless Market share (in 2011)
MTNL	1986	Fixed, mobile, and internet	2 states	State-Owned	9.29 (as of 2012)	14%
Bharati Airtel Ltd.,	1995	Fixed, mobile, and broadband	22 states	Bharti Enterprises (64.76%) Singapore Telecommunications (32%) Vodafone (4.4%)	246 (2012)	20.2%
Idea Cellular	1995	Mobile	22 states	Aditya Birla Group	117 (2011)	11%
Tata Teleservices	1996	Fixed, mobile, and broadband	450,000 towns and villages	Tata Group	85 (2011)	11%
BSNL	2000	Fixed, mobile, internet, and broadband	7,300 cities/towns & 580,000 villages	State-Owned	122.7 (2011)	11%
Vodafone Essar	2000	Mobile and broadband	22 states	Vodafone(74%), Telecom Investment India(19.5%)	146.84 (2011)	17%

Note: Wireless market share is combination of mobile, internet, and broadband services.

Adapted from the following sources: "Top Wireless Firms in India, 2011." Market Share Reporter. Detroit: Gale, 2012. Business Insights: Essentials. Web. 10 Oct. 2012.

Table 3 shows that after liberalization of Indian telecommunications, private operators are the dominant telecom operators with two state owned operators. Bharati Airtel is the dominant mobile

operator with a 20.2% of market share as of 2011. With the increase in providers, there is steady competition in the mobile market.

Telecom Liberalization in China

Reform of China's telecommunications sector has taken place in three stages over a 15 year period of time, beginning in 1994. The MPT implemented telecom regulations and policies under the advisement and consultation with several regulatory bodies associated with the telecommunications networks (Fang, 2005).

The birth of China Unicom. The first stage (1994-1997) of the reforms took place during 1994 and began with the breakup of China Telecom to create China Unicom and China Jitong Telecom. China Unicom provided mobile phones based on code division multiple access (CDMA) technology, while China Jitong Telecom held the fixed lines and mobile phones provided on global system for mobile communication (GSM) technology. According to Ure (2008), China's telecom policy goal was to develop a strong telecom industry, which was important for China's modernization process, while not liberalizing the industry completely. The role of government and its control over the telecommunications sector was deemed important and therefore was not eliminated.

The creation of China Unicom was a significant part of deep reforms led by the CPC Central Committee and State Council in order to develop China's telecom industry (China Unicom, History). A political coalition of ministries and stakeholders supervised the creation of China Unicom (Loo, 2004; Lu & Wong, 2003; Ure, 2008). China Unicom developed as a corporation due to the growing demand for telecom services and the interest of other ministries in the industry's growth. Along with external telecom growth, ministries were also interested in the industry due to special preferential policies given to MPT (Fang, 2005).

According to Gao, the preferential policies included the following three points: 1. MPT could pass the cost telephone line to every subscriber by charging an installation fee; 2. MPT could advance fixed-asset depreciation; and 3. MPT needs to submit only 10% of the profit to the government (as cited in Fang, 2005, p.4). Because of the installation fee charge, the price regulation on fixed line telephones loosened (Fang, 2005). Moreover, according to Li, by 1993 more than half the investments in telecom were collected through installation fees (as cited in Fang, 2005, p.4) As a result, the preferential policies promoted development in the telecom industry.

Lu and Wong (2003) argue that the creation of China Unicom was "more a product of political power than of a market economy" (p.30). China Unicom was not able to create the competition intended and "only captured 1% of the total telecommunications market in 1998" (Ward & Zheng, 2010, p.3). By the end of 1998, the telecom market in China could be called a duopoly but not a fully liberalized market. China Unicom and China Telecom were still state-owned enterprises that were under the control of the CPC Central Committee.

Restructuring the regulatory group. The partial liberalization of China's telecom industry in the 1990s occurred amidst the global trend of telecom liberalization that was occurring in other developing countries. However, unlike other developing countries, China's strategy was to liberalize the industry without privatization. The second stage (1998-2001) of telecom reforms (Ward & Zheng, 2010) began in 1998, with the restructuring of the MPT that was replaced by the Ministry of Industry and Information (MII). The MII, formed by the Chinese government, serves as the regulatory body in charge of designing telecommunication policies, provides guidelines to foster growth of the industry, and implements any of the communication

and information plans approved by the central government (Major Responsibilities of MII, Gov.cn, 2012).

The other important role of the MII is to control basic telecommunication services fees. The MII reserves the right to maintain prices and justifies the right as “a desire to maintain stability in the market and to avoid disruptive price wars" (Mrongowius & Pangestu, 2002, p.10). Such price controls did not create any real competition as the prices were reduced mandatorily by the MII. However, the price reductions initiated by the MII in 1999 created access to telephones in rural areas that had not previously been served (Mrongowius & Pangestu, 2002). The reduction in service fees was due in part to continuous market demands and private interests but also was part of the strategy of the MII and the Chinese government to provide universal service to help China gain entry into the WTO (Loo, 2004; Mrongowius & Pangestu, 2002). Though the MII acts as a regulatory agency to implement telecom services, it is not an autonomous regulatory body. The MII falls under the traditional ministerial hierarchy and is an integral part of the State Council, which makes the final decisions.

Introducing competition in the mobile industry and WTO commitment. In 1999, the MII broke up China Telecom in order to create three state-owned companies based on services provided (fixed-lines, mobile phones, and satellite communications). China Telecom held the fixed line market, China Mobile held the mobile market, and China Satellite held the satellite communications market. The MII’s rationale for separating the mobile market from the fixed line market was to create competition for China Unicom (Ure, 2008). China Mobile was in direct competition with China Unicom but was not an effective competitor as they both provided services on different wireless technologies. Moreover, divesting China Telecom only created partial competition in both the mobile and fixed line market. China Telecom still enjoyed a

monopoly to provide fixed line services, while China Mobile was dominant in the mobile market.

The year 2001 was significant for China's telecom sector and overall trading system as the country joined the WTO. This prompted China to not only open its doors to foreign investment in network equipment but also to enter into joint ventures in the mobile phone industry ("China joins the," 2001). In spite of this new international economic membership, China still strictly prohibited foreign investors from providing basic telecom services. In 2005, the MII announced further efforts to liberalize the telecom sector by gradually relaxing controls over telecommunications fees (CII4, 2005). The National Development and Reform Commission had previously set the fees. This relaxation would allow telecom operators to set fees by themselves based on market forces. As a result, there would be more competition among operators to provide low fees.

The third stage of liberalization. In 2008, the MII became The Ministry of Industry and Information Technology (MIIT). The new ministry consists of 24 departments, one of which is dedicated to wireless communications ("MIIT Inaugurated," 2008). However, the MIIT is still not an independent regulatory organization as it is controlled by the central government. In May of the same year, the Chinese government announced a major restructuring of the telecom industry. The restructuring plan was designed to merge all state-provider telecom operators. The MIIT, the National Development and Reform Commission, and the Ministry of Finance announced the restructuring plan jointly as the last stage of the liberalization process (Fu & Mou, 2010).

To begin, China Telecom would acquire China Satcom and CDMA technology from China Unicom. Second, China Unicom would merge with China Netcom to provide services

under GSM communication technology. Third, China Mobile would merge with China Tie Tong, a fixed-line operator (Lemon, 2008; Shutao, 2008).

Table 4 provides information about the three telecom operators in China based on their wireless market share.

Table 4

China: Telecom Operators

Operator	Year Founded	Services	Operating in	Ownership	No. of Subscribers (millions)	Wireless Market Share (in 2011)
China Unicom	1994	Fixed, mobile, and broadband	31 provinces	Government of PRC	372 (2011)	15%
China Mobile Ltd	1997	Mobile and broadband	31 provinces	Government of PRC	650 (2011)	77%
China Telecom	2002	Fixed, mobile, and internet	31 provinces	Government of PRC	318.11 (2011)	9%

Note: Wireless market share is combination of mobile, internet and broadband services.

Adapted from the following sources: "Top Wireless Firms in China, 2011-2013." Market Share Reporter. Detroit: Gale, 2012. Business Insights: Essentials. Web. 10 Oct. 2012. Additional company websites also consulted.

Table 4 shows that the restructuring of the telecom operators allowed all three operators to provide mobile services; however, China Mobile is still the dominant mobile provider. According to Fu and Mou (2010), the restructuring was mainly due to the following three factors. First, it was necessary to break up the mobile monopoly and address the decline in service quality, as the number of mobile subscribers was increasing and fixed line operators were experiencing differential market shares. Second, a desire existed to create a pathway towards

accessing and providing 3G (third-generation) mobile licenses (Lemon, 2008), and third, there was a desire to help operators develop full-service capabilities (full-service means the ability to provide wire-line, wireless, and internet services). More than providing guidance or helping operators effectively share the market, the main intention behind the restructuring was to accommodate the 3G network in the country and provide more competition (Lemon, 2008).

According to proponents of the restructuring strategy, competition in the mobile market has emerged, but further analysis is required to determine if the competition is real and if the China mobile monopoly has been broken up.

Conclusion

In sum, in noting the six categories of telecom reforms mentioned above, India liberalized its telecom sector with privatization and China liberalized its telecom sector without privatization. Two significant similarities exist in the telecom liberalization processes between China and India. First, both countries restructured the market by increasing competition in mobile markets, and second, both countries created a telecom regulatory agency. However, the strategies for growth of mobile services and telecom overall were different in each country. India opted for an external strategy by liberalizing the basic services and introducing competition through privatization and foreign investment. As a result, private operators account for 43% of India's telecom services revenues (Kumar & Thomas, 2006). India also formally designed and implemented a comprehensive telecom policy. Because of full privatization, more telecom operators resulted in more competition (Table 3). In comparison to India's plan, China's strategy involved retaining government control over the sector and imposing competition internally by dividing state-owned companies based on services provided. Currently in China, only three operators provide basic telecom services (Table 4).

Although competition in these two countries was introduced under different strategies, both still experienced significant mobile market growth. The opening of the telecom market to competition and creating multiple operators in India and in China has contributed to growth in the mobile telecom markets in both countries.

CHAPTER 4

Mobile Phones for Agriculture Development in India

The majority of India's population still lives in rural areas, and agriculture continues to be the backbone of India's economy. Development of rural regions, and especially the agriculture sector, is important for India's economy. Rural development is difficult to achieve with any single policy, which means a need exists for different approaches and policies to encourage development. This chapter will examine India's national strategies and policies that have been implemented in rural areas in order to increase agricultural production using ICTs. The chapter will also examine the policies adopted for access and affordability of mobile phones and their use in the agricultural field. Finally, the chapter will introduce and explain the IFFCO-IKSL program that uses mobile phones for agricultural development. The demonstration of the program is necessary in order to analyze the efficiency of a public-private partnership used to facilitate agricultural production development.

National Policies towards Rural Development

India recognizes that development and modernization of the agricultural sector is the most important factor for rural development, as more than half of India's population resides in rural regions and depends on agriculture for its livelihood. The GOI included programs and strategies for rural development in the country's five-year plans. The five-year plans were introduced in the country after country's independence in 1947, with the first five-year plan introduced in 1951. The GOI also designed various policies in order to improve India's infrastructure, increase agricultural productivity, provide rural employment, and subsidize food

items via a more efficient distribution system. The GOI implemented the policies at both the national and local levels.

In the year 2000, the Department of Agricultural and Cooperation (DoA&C) issued a National Policy framework for agricultural expansion. In an attempt to communicate and transfer information at a low cost, the policy focused on using information technology (IT) to promote communication between researchers, extension workers, and farmers (as cited in Saravanan, n.d., p.2). The DoA&C also emphasized the importance of building an IT-based infrastructure with information kiosks, applications for marketing, access to electronic mass media, and support to state governments by using IT to expand agricultural capacity and output (as cited in Saravanan, n.d., p.2).

In the year 2005, the national government created the Right to Information ACT (RTI). The RTI ACT requires government officials to respond to a citizen's request of government information in a timely manner. All departments, including the agricultural department, are obligated to follow the RTI ACT. The RTI ACT has empowered Indian citizens seeking information about government's matters that affect them. It has been controversial as to how much information is provided, but it also has created a large number of social activists (Mathur, 2013).

In the Tenth Five-Year Plan (2002-2007), India emphasized greater use of new ICTs. The plan focused on using ICTs in education, agriculture, and government offices. Specific to the agricultural sector, a National Policy for Farmers (2007) was issued to encourage the use of ICTs by the DoA&C. The policy opened Gyan Chaupel (Knowledge Centers) in villages to provide information to rural people (as cited in Saravanan, n.d., p. 2). A variety of programs have been developed to facilitate broad based development by the Common Service Centers (CSCs) of the Department of Information Technology, the Ministry of ICT, and the GOI, as well as state

governments and the private sector (as cited in Saravanan, n.d, p.2). The policy also tends to resolve the last mile and last person connectivity challenge with the help of broadband, the internet, and community radio or internet-mobile phones. Overall, the focus of the policy was to not only increase agricultural production but also to focus on the economic well-being of the farmers.

The above policies were designed to increase agricultural production and infrastructure using various ICT projects. In particular, access to telecommunications is an important component of development programs focused on increasing access to and use of mobile phones. It is important to examine India's policies that were implemented to increase access and affordability of mobile phones in rural regions. Chapter 3 provided India's overall telecom framework and policies. The following section will look at the Universal Service policy especially designed to provide access to phones.

India's Universal Service. India's definition of Universal Service is similar to the definition defined by the International Telecommunication Union (ITU). Universal Service was first introduced in the 1999 Telecom policy, but it was not fully implemented until 2002. TRAI was given the responsibility to recommend a funding mechanism, and after a consultation process, the TRAI provided recommendations to the government, and the policy subsequently was released in 2002. The policy includes a Universal Service Fund that aims to accomplish the following four points:

1. Provide widespread and non-discriminatory access to quality ICT services at affordable prices to all people in rural and remote areas.
2. Provide an effective, powerful linkage to the hinterland to connect the populations of rural and remote areas with urban centers.
3. Ensure that Universal Services are provided in an economically efficient manner.

4. Ensure that the benefits of inclusive growth bring rapid socio-economic development and an improved standard of living to previously unconnected areas. ("Universal Service," 2002)

This policy, drafted in 2002, was aimed primarily at providing traditional phones to Indians in rural areas. India has since renewed the policy to include the provision of mobile phones, highlighting India's strategic policy changes to include new technology for rural communication. In 2006, The Indian Telegraph Act of 1885 was amended to include mobile services and broadband connectivity in rural and remote areas. The already-established Universal Service Fund for traditional phones now helps to increase network development for mobile services. The Universal Service Levy, created in 2003, generates resources for the fund. It is mandatory that five percent of gross revenues generated by telecom operators are contributed to the levy. Only operators who provide value-added services are exempt from paying the levy. Additionally, the central government provides additional funding through grants and loans ("Universal Service", 2002). These policies indicate that India has recognized the importance of access to mobile phones and acted accordingly.

India's strategic plan to include mobile phones through the Universal Service plan is a model for other developing countries. While the mobile penetration rate in rural India is lower compared to that of China, this is primarily due to increased operating costs associated with expanding coverage to service more mobile consumers ("India needs to," 2008). International agencies along with telecom companies have petitioned the government requesting a tax reduction. However, the government has not shifted its stance. The Universal Service policy addresses the accessibility of mobile phones to rural people, but the price or affordability of mobile phone devices is determined by telecom tariffs and market demand.

The Universal Service policy and fund is one way to provide access and communication to rural people. Another option to extend access and service to rural communities at affordable

prices is multi-stakeholder partnerships between the private and public sectors. Public and Private Sector Partnerships (PPPs) are defined as "cooperative venture[s] between the public and private sectors, built on the expertise of each partner, which best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards" ("Financing Universal Access and Service", section 4.5.4.1, n.d). According to the ICT Regulation Toolkit[8] section 4.5.4.1, PPPs are driven by two forces. One force is the recognition that the private sector has superior management skills, knowledge of market forces, and is financially efficient but has limited tolerance for risk. The second force is that government is responsible to meet the social and developmental needs of citizens, coupled with available financial resources, in order to reduce the financial risk of private sector corporations. Examples of PPPs in India include Life Tools by Nokia, Mandi on Mobile Services by state-owned BSNL, Reuter's Market Light (RML), and IFFCO Sanchar LTD. These PPPs form a mobile link between farmers and markets. The next section looks at the IFFCO Sanchar LTD model to evaluate how effective the public-private partnership is at disseminating information through mobile phones. The success of the model and program depends on sustainability and the enrollment of farmers to use modern technology.

[8] ICT regulation toolkit is a joint production of infoDev and the International Telecommunication Union that provides journals and articles contributed by regulatory authorities of telecom and ICTs, researchers/academics, private sector entities, etc.
<http://www.ictregulationtoolkit.org/4.5>

India Mobile Phone Impact in Agriculture: IFFCO Kisan Sanchar Program

"*Today, India [is] a leader in using technology to empower farmers, who get free updates on market and weather conditions on their cell phones.*"[9] –President Barack Obama.

In 1967, the Indian Farmers Fertilizer Cooperative Limited (IFFCO), a cooperative society of farmers, formed and registered to distribute fertilizers. The parliament of India enacted a Multistate Co-operative Societies Act in 2002. As part of this act, the IFFCO is registered as a state-run cooperative with the mission "to enable Indian farmers to prosper through the timely supply of reliable, high quality agricultural inputs and services in an environmentally sustainable manner, and to undertake other activities to improve their welfare" (Mission, n.d.). The co-op serves mostly small farmers who have less than an acre of land and who often have difficulty getting accurate and timely information about selling and buying goods. The co-op helps farmers eliminate brokers or intermediaries when purchasing goods and thus saves them money.

IFFCO maintains strategic partnerships with other cooperative societies and institutional agencies. Some of these agencies are the Department of Agriculture and Cooperation, the Ministry of Agriculture for Agricultural Statistics, the Directorate of Economics and Statistics, the India Council for Agricultural Research (ICAR), and the Ministry of Non-Conventional Energy Sources. These partnerships help obtain information about government resources and services that assist farmers in reducing costs. Information was initially provided through traditional methods like village centers, newspapers, and televisions. With the changing technology, IFFCO also utilizes new technologies in order to reach farmers faster.

IKSL overview. IFFCO formed a subsidiary called IFFCO Kisan Sanchar Ltd (IKSL) in order to pursue economic and communication development in rural areas and place an emphasis

[9]"President Barack Obama's Remarks to India's Parliament", Wall Street Journal, November 8, 2010. < http://blogs.wsj.com/indiarealtime IKSL Overview: /2010/11/08/president-barack-obamas-remarks-to-indias-parliament/>

on increasing agricultural productivity and the welfare of farmers through new technology-mobile phones. This subsidiary formed a joint venture with Airtel, the largest private mobile company in India along with Star Global Resources Ltd.,[10] a rural telephony expert. The joint venture resulted in a pilot program to provide agricultural-based information through Value Added Services (VAS) on mobile phones. The program was initially test-marketed in Eastern Uttar Pradesh to determine whether or not farmers were willing to use the mobile applications as information resources.

Partnerships. Both public and private organizations have a strategic interest in making the IKSL program a success, and each partner plays a vital role in the program. The partners include Airtel, which has the largest network and mobile customer base in India. IFFCO and its strategic partners provide information for new products and services and are able to reduce the call rates for their clients. The partnership is a win-win deal. Airtel is able to market its products and services to new markets in rural areas and fulfill its universal service obligation required by the Indian government, while the IFFCO strengthens its cooperative movement in rural India by providing information that boosts the rural economy ("IFFCO and Bharti Airtel…", 2008).

Program design. One unique aspect of this program is that Airtel prepared a sim card called the IFFCO-Airtel Green Card. The card works as a normal sim card with other advantages that focus on agricultural data. The card provides up to five voice messages per day for a minute, and the cost of informational messages related to agriculture is free. The IFFCO provides information and agricultural data to Airtel, who then sends the information through voice messages to program subscribers. As a multi-ethnic society with multiple languages and

[10] Entrepreneur Rajan Sharma, who actually initiated the idea, founded Star Global Resources Ltd. Sharma had great knowledge about rural areas and had expertise in fertilizer industry. During fieldwork, he realized that credible information is hard to deliver to farmers for agricultural productivity. This is when Sharma approached IFFCO and Airtel requesting to form partnerships to deliver information through mobile phones (Thomas, Business.in.com, 2011)
<http://business.in.com/printcontent/22412>

different climate conditions, Indian PPPs have unique challenges associated with disseminating information. In order to overcome the language barrier, the IFFCO designed customized and localized information. Messages pertaining to crop prices and local weather conditions are geographic-based and are delivered in the local language. The unique ability of the model to deliver information in regionally based local languages encourages farmers to enroll in the program.

The IKSL program provides the following types of information to farmers:

1. Soil, crop, dairy, and animal husbandry management
2. Horticulture and vegetable management
3. Plant protection
4. Market rates
5. Weather forecasts
6. Human and cattle health
7. Employment opportunities and government programs

In addition to this information, the program also has a dedicated helpline that allows the green card subscribers to enter a number and receive a solution or answer to their problems and queries. It also includes a call back facility where subscribers can enter a short code to listen to the messages if they missed the voice message call. IKSL also organizes a live "phone-in" program on specific subjects for farmers. A mobile phone-based quiz exists to encourage subscriber participation.

Outcomes of the program. The IKSL program was launched in June, 2007. Table 5 shows the highlights of the program through April 2012, and Figure 4 provides the IKSL subscriber base year over year data.

Table 5

IKSL Highlights

No. of subscribers	5 million
No. of states covered	18 of 28 states
Experts on panel	53
Total messages broadcasted	68,056
Feedback messages	3,098
No. of communities focused	105
Active listeners	1.3 million

Note: The 5 million subscriber base is an estimate

Adapted from the following sources: Ficarelli and Glendenning (2012); Highlights, iksl.in

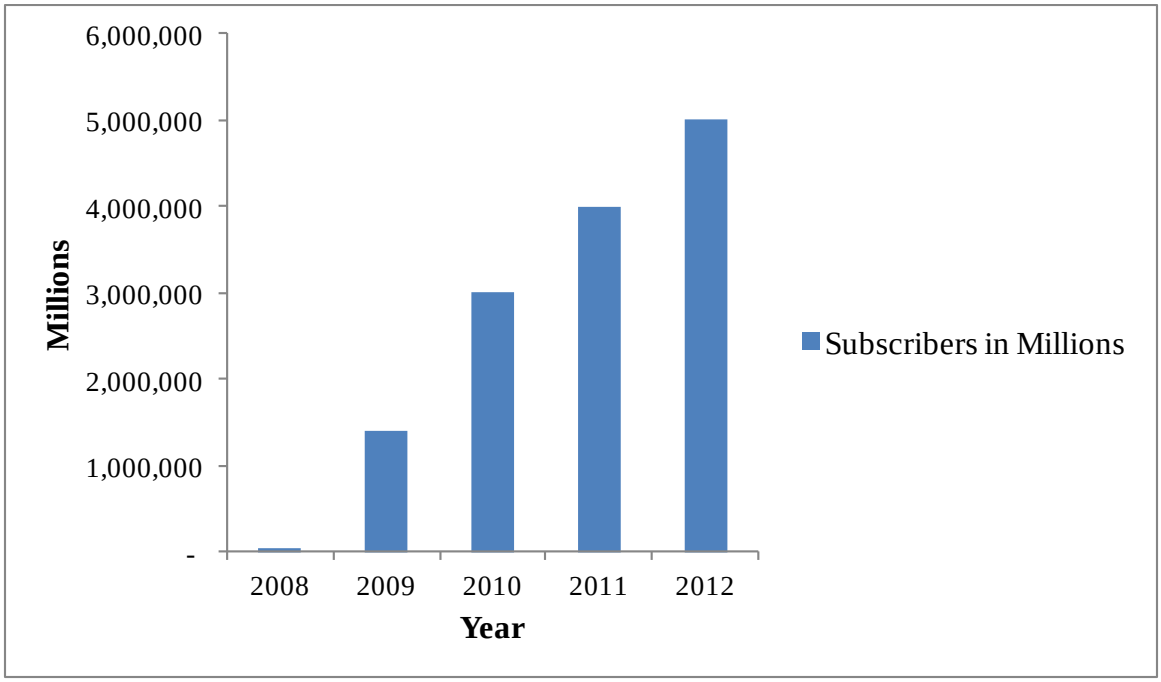


Figure 4. IKSL Subscriber Base Year over Year. The graph illustrates the increase in IKSL user's enrollment from 2008 to 2012. Data obtained from Ficarelli and Glendenning (2012, p.22); Jha (2011) ; Srinivasan, S (2010); Smith & Westhead's (2011). The data is an estimate only.

The program had a subscriber base of 1.4 million within a year from its launch date and has grown to 5 million farmer users by 2012. The program has increased at a compound annual

growth rate of 37.47% from the years 2009 to 2012. It has been implemented in 18 states out of 28 Indian states while delivering 68,056 messages to farmers; overall, the farmers provided 3,098 feedback messages regarding the program content (Highlights, IKSL.in). The expansion of the program to 18 states and the increase in number of subscribers indicates the sustainability of the program.

According to Smith and Westhead's (2011) case study produced by GSMA and the study by Gandhi, Mittal, and Tripathi (2009) commissioned by Vodafone, the program was successful due to its customization and easy access to information. Customized information is provided regardless of the location or crop. In addition, the information comes as a voicemail instead of a text message, which farmers prefer due to low literacy rates.

Another aspect of the program that helped increase the number of farmers and workers participating in the program in the 18 states is that the national and state institutions provide the content. According to the Smith and Westhead (2011) study, three factors are at play in this success. First, the percentage of users that reportedly trusted the information as accurate was 98.3%. Second, the percentage of users that rated the service as better compared to other sources was 75%. And third, 74% of helpline callers and 64% of voicemail message listeners reportedly had implemented the techniques or planned to implement the information received. These results reveal that subscribers perceive the information provided by these PPPs as valid, helpful, and trust-worthy.

The study by Gandhi, Mittal, and Tripathi (2009) shows that farmers benefited from the information they received through IKSL and mobile phones overall. Farmers enjoyed cost savings, increased revenue, and experienced first-hand how mobile phones may be used as a convenient tool to get information quickly. According to the study, "The benefit farmers reported ranged from 5-25% of increase in earnings" (Gandhi, Mittal, & Tripathi, 2009, p.29). The

information obtained through mobile phones saved costs by avoiding crop losses due to weather, improved prices, and increased revenue through higher yields. Mobile phones are convenient and cut the travel costs previously incurred in transferring information from kiosks or knowledge centers. With mobile phones, farmers obtain information from the field that enables them to make strategic decisions.

Conclusion

India recognized the importance of ICTs in rural and agricultural development. Various policies (at the national and state levels) that included ICTs were developed and implemented to promote progress in the Indian agricultural sector. Although IT programs such as AGRISNET, Kiosks, and e-governance were implemented, a significant portion of the population still lacked access to fast and reliable information due to financial, bureaucratic, and administrative issues. In such scenarios, mobile phones proved helpful in providing information at a faster pace. India recognized the importance mobile phones in development terms and implemented national policies and strategies to increase availability and access to mobile phones. The IFFCO-IKSL case study highlights the benefits of a public-private partnership. Involvement of state and national institutions with private sector and local beneficiaries contributed to positive results as well as the design and implementation of the program. It has been proven to be a win-win situation for all partners and participants in the program as it benefits farmers who are in need of fast, reliable, and accurate information.

CHAPTER 5

Mobile Phones for Agricultural Development in China

Recognizing the importance of information access in rural areas, the Chinese central government introduced a number of plans and strategies to provide information services to rural villages and farms. To implement its strategies the central government included local governments, corporations, and other participants like village leaders in the programs. For example, agricultural business, wholesalers, intermediary agencies, and households in major cities and provinces were interconnected under a network called the "rural market information service network" (Yongling, 2004, p.1). These central government strategies were designed to strengthen communication and information systems and increase agricultural productivity.

This chapter will assess the progress of China's government-run program to disseminate market information to villages and farmers. China Mobile, the state enterprise chosen by the government to launch the RIN, provides the infrastructure necessary to connect rural and urban China.

National Policies towards Rural Information Development

Table 6 lists the central government strategies designed and implemented using China Mobile's infrastructure in order to develop a comprehensive information system in rural areas.

Table 6

China Information Development Strategies

Year	Plan	Strategy
2001	10th Five-Year Plan(2001-2005)	1. Implement rural information services. 2. In 2003, a "rural economic information release calendar" was introduced as the main stem for dissemination agricultural information
2006	11th National Economic and Social Development	1. Integrate agriculture-related information resources.

	Five-Year Plan (2006-2011)	2. Strengthen the rural economic information application system construction. 3. Promote agriculture service organization and mechanism innovation. 4. Encourage and guide farmers to develop different types of specialized cooperative economic organizations and improve the organization of agriculture.
2006	Deployment of agriculture informatization in the State Informatization Development Strategy, 2006–2020	1. Improve rural network coverage. 2. Integrate agricultural information resources. 3. Standardize and complete the public information intermediary services. 4. Customize urban and rural areas information systems based on the area. 5. Provide farmers access to information resources at affordable prices and train using the resources appropriately.
2007	National Agriculture and Rural Informatization Construction, 2007–2015	1. Greatly improve agricultural and rural integrated information infrastructure. 2. Enhance modern agriculture, rural public services, and social management. 3. Fully develop information service organizations at the township and village levels. 4. Gradually complete a sustainable development mechanism for agricultural and rural informatization—that would fulfill the development needs of modern agriculture and the construction of a new socialist countryside.

Adapted from Qiang, Bhavani, Hanna, Kimura, & Sudan, 2009.

Acknowledging the need to bridge the digital divide between urban and rural China, the government's 10th Five-Year Plan focused on building a rural telecommunications infrastructure to offer rural market information services. The information services include providing computer and internet access to individuals by building public facilities and improving IT infrastructure in rural regions (Qiang et al., 2009).

In the 11th Five-Year Plan (2006-2011), the nation adopted policies to reduce rural poverty and improve the living standards of farmers through ICTs (Wan et al., 2008). One of the

key policies of the plan was to provide information to rural areas. The term "informatization" is used to describe "the transformation of an economy and society driven by information and communication technology (ICT) (Qiang et al., 2009, p.1). The term was coined in China to specifically target and improve the living standards and lives of rural citizens. The objective of the informatization policy was to integrate and modernize the rural market economy through ICTs. Focusing on agriculture, the goal of the plan was to promote increased trade and industrialization (Xia, 2010)

The informatization plan has central government officials, telecom providers, ministry officials, and government agencies at all levels were involved in the design and implementation of programs designed to reduce poverty. Involving different participants, the Department of Agriculture issued two strategic policies in 2006 and 2007 targeting agricultural development. The first strategy envisioned was an integrated information infrastructure and an information service organization intended to promote modern agriculture in villages throughout the country (Qiang et al., 2009). The second strategy included an integrated infrastructure designed to connect villages and provide farmers access to information centers equipped with telephones and computers that would enable them to access to information about agricultural products.

The goal of these information development strategies was to help reduce poverty and increase agriculture production. The government acknowledges that the issues of poverty reduction and food security are important to sustain continued economic growth. Building an infrastructure that allows farmers to access information and resources locally will help them to increase quality and yields. In turn, higher agricultural yields will help improve the living standards of the farmers. In order to accomplish this, the Chinese government argued that communication is an important tool necessary for rural economic growth and therefore took the initiative to introduce phones in every village.

Village Access Program

China did not adopt a definition or concept of "Universal Service" similar to the Universal Service programs in the United States or India. However, in an effort to provide telecommunications services and access to rural people, the Chinese government introduced "Cun Cun Tong" (Connect Every Village), more often known as the "Village Access Program" (VAP), in 2004. The implementation process for this program is different from that of the Universal Service policies in the United States and India, as it was more in line with China's conditions and its culture. The program incorporates the building of the actual network infrastructure in its plan, unlike the Universal Service programs in the United States and India where the policy goal was only to provide access to rural areas.

VAP objective. The goal of the VAP is to provide villages that do not have access to telecommunication services with access to phones (either landline or mobile phones). The program aimed to reach 40,000 new administrative villages with two years after implementation (Lu & Xia, 2005). The objective also aimed to provide internet access to all towns and encourage ICTs throughout the country.

VAP organizers and executors. The Ministry of Information and Industry (currently the Ministry of Industry and Information Technology (MII)) was responsible for the design and the implementation of the program. The MII, six state-owned telecom operators,[11] and other central and local government ministries were required to contribute by funding and providing service toward achieving the goal.

VAP time of implementation. Table 7 provides the different time and phases of the VAP.

[11] The six-telecom operators are China Telecom, China Mobile, China Netcom, China Unicom, China Satcom, and China Tietong

Table 7

Three Phases of VAP

Phase	Year	Objective
Phase 1	2004	Design and implement the VAP
Phase 2	2005	95% of villages must have phones by year end
Phase 3	2006-2010	Build information service platform to provide internet access

Adapted from Village Phone Program, MII

Phase 1 (2004). VAP was launched in January 2004 on a trial basis in five provinces: Shaanxi, Mongolia, Sichuan, Guangxi, and Henan. (Lu & Xia, 2005). The program was introduced in the select provinces to determine the feasibility of the program. Once the program was proven successful, the program was expanded to other provinces, still during 2004, and was officially launched in 2005 throughout the country.

The program incorporates the building of the actual network infrastructure in its plan, unlike the Universal Service programs in the United States and India where the policy goal was only to provide access to rural areas. To fund the program, China launched the Universal Service Fund (USF) that is in line with international practices. Each operator (fixed and mobile company) was charged about US$ 0.03 for each phone number it owned (Kirby, McFarlan, Donovan, & Manty. 2009).

Phase 2 (2005). Phase 2, considered an important phase of the program, was officially launched in 2005 after a trial basis. MII, along with local governments and the incumbents, was targeted to achieve at least 52% of the 95% goal within phase 2. To achieve the goal, the six incumbent telecom providers were required to connect and provide services to a total number of 33741 administrative villages (Lu & Xia, 2005). In addition, the government along with landline phones made mobile phone research and development a top priority and marketed the phones as the "people's phone," encouraging consumers both in urban and rural areas to purchase a phone

(Cheung & Kshetri, 2002, p.24). It is noteworthy that similar to India, China also realized the importance of modern technology like mobile phones to promote the growth of rural communication.

Phase 3 (2006-2011). During the years 2006-2011, access penetration reached 99.7% (in 2009) as MII extended the program to other administrative and natural villages that were not included in the first phase[12] (Xia, 2010). Moreover, the program provided access to broadband and internet services enabling farmers and other rural citizens to apply for ICTs in order to receive information regarding agriculture and other business areas that are necessary for productivity.

The above achievements were made possible with the six telecom operators that were shouldered with programs from MII to deliver the Universal Service to all villages based on their operating administration regions. As China Mobile is the highest contributor to the mobile market, the following section focuses how China Mobile, a state enterprise, collaborated with other government agencies to oblige the Universal Service goal by the government and provide agricultural information to farmers.

China Mobile Agriculture and Rural Information Service

Overview of China Mobile. China Mobile Limited Group (hereafter called China Mobile) is the world's largest mobile phone company with 649.57 million subscribers as of 2011 (Financial Results for 2011, China Mobile Ltd). China Mobile formed in 1999 after the break-down of China Telecom.; China Mobile a major stakeholder of the wholly owned subsidiaries that operates in all 31 provinces (autonomous regions and municipalities under central government).

[12] According to Chung (2004, p.79), the natural village is a village that is formed and exists naturally, whereas an administrative village is a village combined with several natural villages that have administrative functions. The size of the administrative village differs based on the place and has about a population of 2,000.

China Mobile is the leading monopoly in the development of mobile communications in China. To support the government sanctioned VAP program and to narrow the digital divide between rural and urban areas, China Mobile launched the RIN program in 2006 (Sustainability Report, 2010). The purpose of the RIN program and the goal of China Mobile was to "address the communication needs of disadvantaged groups and provide convenient services and universal access and network coverage" to villages across China (Sustainability Report, 2010, p. 24). Based on China Mobile LTD's sustainability report (2010), the company provided coverage across 22 provinces and 14,128 natural villages by the end of 2009.

Table 8

Provinces Covered under RIN

Region	**Provinces**
Eastern China	Liaoning, Zhejiang, Fujian, Hainan, and Jiangsu
Central China	Hebei, Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan
Western China	Inner Mongolia, Guangxi, Chongqing，Sichuan, Guizhou, Yunnan, Shan'xi, Gansu, Qinghai, and Xinjiang

Compiled by author

By the end of 2010, China Mobile completed the construction of the RIN platform, which provides the capacity to access digital information in rural areas. Table 9 provides the statistics of the VAP from the year 2008 to 2010.

Table 9

Statistics of VAP 2008-2010

	2008	**2009**	**2010**
Cumulative number of administrative villages connected via VAP	41,843	43,715	45,514
Cumulative number of natural villages connected via VAP	19,904	34,122	43,570

Adapted from Sustainability Report, 2010

Based on the above statistics, it can be seen that the network has covered 100% of administrative villages and 94% of natural villages.

RIN program. Due to China's highly centralized government, the best strategy for a company to expand its market is to collaborate with local and central government agencies in order to acquire resources and access to rural markets. China Mobile collaborated with the Ministry of Industry and Information and Ministry of Agriculture to implement the RIN program that provided the Agricultural Information Network Platform for Rural Areas (Sustainability Report, 2010).[13] China Mobile and the Ministry of Agriculture also signed an agreement called the strategic cooperation framework for promoting rural informatization. Both parties agreed to public-private partnership principle design to increase and improve access to digital information in rural areas.

***RIN program model and details*.** The goal of the RIN program is similar to other ICT pilot programs. The program aims to provide and improve access to information to farmers through mobile phones. It was implemented in 2006 and then enhanced in 2009 in order to provide better service to rural people living on agriculture as source of income. The program provides short text messages (SMS) and voice service through mobile phones that include data related to news and government policies. Along with SMS, the program also provides information through rural information terminals or hotlines accessible by dialing 12582 or accessing the website, 12582.com, via a computer or mobile phone. The RIN program relies on rural information terminals set-up in rural villages. The service costs two Yuan a month and sends out 13m text messages a day ("Beyond voice-New uses," 2009). The website service is

[13] It is interesting to note that the MII selected China Mobile to implement the VAP program, which in turn helped China Mobile to expand into rural areas.

accessible through Wi-Fi/Internet that requires broadband service that may be accessed using a mobile phone. Voice message services are provided in ethnic languages based on location. Below are the ten types of information provided through the program:

- Agricultural policies, laws, and regulations
- Agricultural news
- Agricultural technology
- Price and product information
- Pest management and prevention
- Market developments
- Agricultural weather forecasts
- Labor information
- Emergency alerts
- Lifestyle and health

Locally customized program offerings. According to a field study by the FAO and the Chinese Ministry of Agriculture in 2004, Chinese information needs are extensive and diverse based on each province (Yongling, 2004). The study was conducted in four provinces: Zhejiang, Anhui, Jilin, and Ningxia. Based on the results of the study, China Mobile Ltd., along with its subsidiaries, developed different regional level programs to meet the different regional needs. China Mobile designed program applications to help farmers highlight the research conducted to develop individualized programs. Below are examples of RIN programs developed by China Mobile and its subsidiaries in various regions.

Weather and irrigation system program. Farmers in Jilin province lacked an efficient irrigation system and access to weather forecasts. Controlling the irrigation system based on the weather is important to planning and harvesting. In order to support the farmers, the China

Mobile subsidiary in Jilin developed a mobile-based system that allows farmers to use mobile phones to monitor humidity, temperature, and light in greenhouses and control operations such as automatic irrigation and sun covers. This system helps farmers to produce more seedlings, decrease farm diseases and consequently, improve agricultural productivity ("Narrowing the Digital Divide," 2009)

Jilin province is in the northeastern part of China and has a population of 27 million as of 2011 that speaks various dialects (Economy, engligh.jl.gov.in). According to Jilin's government, per capita income in urban areas increased 9.17%, and rural income increased 6.8% from 2008 to 2009. The precise contribution to this increase that is attributable to the adoption of mobile phones cannot be determined. However, based on Jilin government data, in 2010 there were 15.742 million mobile phone subscribers, with a mobile phone penetration rate of 57.6 per hundred persons, which was a 7.7% increase from 2009 (China Statistical Year Book, 2010)

3-tier agricultural information. China Mobile in Guangdong developed a user-friendly, 3-tier agricultural information service under RIN. Guangdong province is in the South China Sea coast with diverse geography that is divided into four regions: Pearl River Delta, Eastern, Western, and Mountainous regions. The province has topped the population growth and GDP growth rate among all provinces. It has population of 85 million as of 2010, and about half the population (40 million) lives on agriculture (Guangdong Statistical Year Book, 2011). The GDP increased to $731 billion in 2010 from $172 billion in 2000 (Guangdong Statistical Year Book, 2011).

The services provided by China Mobile are available to Guangdong customers free of charge or at a low cost. Service users can sign up to receive free legal and policy updates and weather forecasts as well as news on agricultural topics, trends, and pricing. Along with customized information, the program allows farmers who signed up for the program to receive

specialized information through daily instant messages (Donovan, Kirby, McFarlan, & Manty, 2009).

Outcomes of RIN program. One factor directly contributing to the success of the RIN program has been the central government's aggressive plan to connect all villages. The other factor contributing to the success of the RIN program in agriculture services is an increase in the living standards of rural farmers due to the information provided to help their agriculture production. The number of subscribers to the agriculture information service is used to determine its success (see Figure 5).

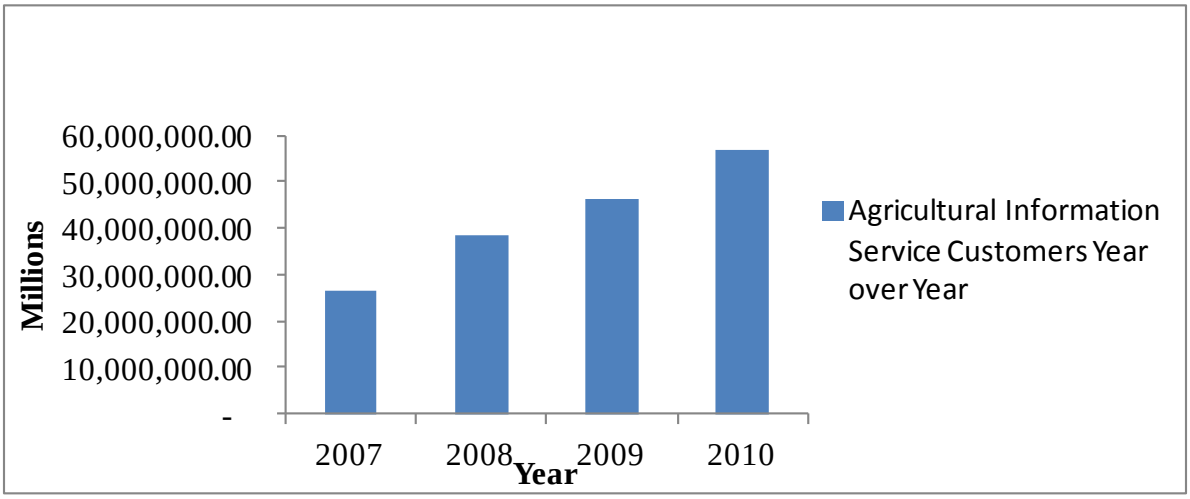


Figure 5. RIN Agricultural Information Service Customers Year over Year. The graph illustrates the increase of agricultural information service subscribers under RIN from 2007 to 2010. Data obtained from Narrowing the digital divide (2009) and Sustainability Report (2010), China Mobile Ltd

Figure 5 shows that the number of customers on the agricultural information service increased at a compound annual rate of 21.1% in four years. Within three years after the program started, the number of customers reached 50 million users, which is a relatively high number within a short span of time. However, the percentage of customer growth was faster for the first couple of years but slowed down in later years due to challenges posed in the program.

One challenging factor is that the agriculture information only comes from government sources, and having a single source can affect the effectiveness of the information. China Mobile had to determine whether it would be sustainable and beneficial for the company to adhere to the government's demands because building a rural infrastructure is difficult and expensive and profit margins are small (Donovan, Kirby, McFarlan, & Manty, 2009). However, given that urban telecommunications markets areas are approaching a saturation point, a clear competitive advantage of forming a partnership with the government is the ability to enter rural areas at a faster pace.

Conclusion

The Chinese government recognized the importance of information and communication technologies and implemented these concerns into its national policies and strategies. Acknowledging the need to bridge the digital divide between urban and rural China, the central government created various policies for rural regions. Its aggressive nature has led to 95% coverage of administrative villages with basic telecommunications. To implement its strategies and programs the central government involved local governments, corporations, and other participants like village leaders. To support central government goals, China Mobile launched the RIN program in order to connect villagers with mobile phones and provide agricultural information. China Mobile, a state-owned company, is the major mobile company and acts as monopoly in the mobile industry. Therefore, it can be concluded that the company has no choice other than to support the central government goals. The RIN program data indicates that it was successful in the villages and that farmers benefited with the information sent through texts or helplines.

However, the VAP may face challenges due to technological changes, China's entry into WTO, and political and economic uncertainties. The ICTs are being reshaped through new technologies, and China's entry into the WTO might affect regulatory reform. Providing ownership of VAP for one major company might have an impact when the country faces economic uncertainties.

CHAPTER 6

Discussion, Conclusion and Limitations

By looking at the telecom policies, strategies, and agricultural programs focused on expanding mobile telephone use in both countries; the aim of this thesis is to examine the collaborative efforts of public and private agencies in India and the role they do in disseminating information to farmers through mobile phones when compared to the government agencies in China that have been created to share that information in order to determine which program is more effective. This chapter provides a discussion of the findings of the IKSL program in India and the RIN program in China based on the comparative method. In addition, this chapter also provides a section on conclusion and limitations of the thesis.

Discussion

India and China made diverse changes to the telecom industry in order to support its growth. Both countries restructured the market by increasing competition in mobile markets and created a telecom regulatory agency. However, they implemented different strategies for the overall growth of the industry. India opted for an external strategy by liberalizing the basic services and introducing competition through privatization and foreign investment and creating a comprehensive telecom policy. On the other hand, China's strategy involved retaining government control over the sector and imposing competition internally by dividing state-owned companies based on services provided.

Both countries recognized the importance of ICTs in rural regions and implemented computer based or mobile-based programs. A significant portion of the population still lacked access to fast and reliable information due to financial, bureaucratic, and administrative issues. In such scenarios, mobile phones proved helpful in providing information at a faster pace.

As discussed in Chapters 4 and 5, the IKSL program in India and RIN program in China illustrate how agricultural information through mobile phones can be provided to farmers through collaboration of different actors. The study reveals a number of positives, including an increase in agricultural output, an increase in farmers' income, and the creation and dissemination of agricultural education inputs.

Table 10 provides an overview of the comparison of key features of the two programs.

Table 10

Comparison of Key Features of IKSL and RIN Programs

Category	**IFFCO-IKSL**	**China Mobile-RIN**
Launch date	2007	2006. Since 2009 RIN has focused more on agricultural informational services
Partners	Airtel, IFFCO, Star Global Resources Limited, Government of Agriculture, TRAI, India Council for Agricultural Research	China Mobile, Ministry of Agriculture, Ministry of Information Industry
Cost of the service	Free Voicemail Services. Helpline service available at .50 paisa or $25.00	Free of charge in a few provinces or $6 a day for service per phone in a few provinces
Nature of delivery	Voice Message & helpline service	Voice, SMS, Website & Hotline services
Number of daily messages per phone	5 voice messages	13m text messages
Information provided	Weather Crop/animal husbandry advisory Electricity timings Employment opportunities Fertilizer requirements and availability Government schemes Horticulture and vegetable management	Agricultural laws and regulations Agricultural news Agricultural technology Emergency alerts Labor information Lifestyle and health Market developments Price and product information Pest management and

	Human and cattle health Market prices Weather forecasts	prevention Weather forecasts
Number of subscribers	1.4 million (in 2009) 5 Million (in 2012)	26.43 million (in 2007) 56.87 million (in 2010)
States/provinces	18 states	13 provinces; later expanded to cover the nation

Notes: The cost of the service is based on the exchange rate as of June 2012

In order for any ICT program to work successfully, governments need to be receptive to the innovation of delivery of services by the technology providers. By looking at both countries' programs, there is no doubt that the programs have been successful and sustainable in their respective countries as governments in both countries were receptive to adopt modern technology. The success of each program is determined based on the number of subscribers enrolled in it over the years (Table 9).

The success of the IKSL program occurred through the inclusiveness of the public and private sector with the help of government policy changes in telecom industry. The success of the RIN program can be attributed to the diligence exerted by the central government in making local government, institutions and state enterprises obligated to participate in its strategy. However, the primary outcome to assess is to see how accurately and efficiently the information is delivered and to compare how successful the programs are over time; in particular, this is important because farmers require accurate and timely information on agricultural techniques in order to increase production.

The key similarities between the programs are application design, content provided, and customization based on the locality. The information and data provided to farmers is modified based on the needs and language used in that particular state or province. The programs also have common constraints such as lack of education amongst the population being served. People

living on agriculture as their primary source of income generally have a low education level. Therefore, farmers would not be aware of technology updates or market information unless training is provided.

Significant differences exist in terms of the sources and the efficiency of the information delivered under each program. The RIN program lacks the inclusive participation of the subscribers (farmers) or private actors in the decision making process regarding what information is needed and useful. In an authoritarian regime, citizens will (or have to) accept any service provided by the government as they have minimal or no choice. Moreover, there is probability that the government controls on the information passed. For example, if there is a information on crop spoilt because of bad seeds or faulty fertilizers. Such news is could be controlled from spreading, as content and service is managed by state agencies. The farmers will be completely dependent on the government regarding when and what information is delivered. This dependency can lead to lower production and thus result in lower income for farmers. One of the limitations of this thesis is that it could not measure the impact of this dependency.

The case of IKSL can be considered a successful and sustainable public-private partnership in delivering information in a more timely and accurate fashion. This is because the findings from Figure 4 and Figure 5 on the number of subscriber's percentage growth over the years demonstrates that subscribers included in the IKSL service programs grew to 37.47% in four years, whereas under the RIN program, subscribers grew at 21.1% in four years.

Three other reasons appear to contribute to the success of IKSL. First, a strong connection between the cooperatives, farmers, and government is important for trust between them to develop and also for the cooperative to be a success. This connection had already been established by IFFCO, as it is the oldest farmers' cooperative society in India with a strong presence among farmers and government insitutions. Second, cooperative societies cannot afford

to adopt new technologies because of limited financial resources, so dependency on public and private sectors makes sense. In the case of IKSL program, IFFCO created the farming clients list; provided information on fertilizer, new seeds and other agricultural inputs obtained from government and other agencies; and negotiated a lower price with private companies that offer mobile services. Finally, the third reason for the success of the IKSL is that government provides the information; however, the information should be analyzed for its accuracy and redelivered through a service in a timely fashion. Airtel, a private company, had the ability to invest in efficient systems to collect and analyze data, develop services based on demand, and disseminate information. This comprehensive public-private partnership led to a platform that delivers fast and accurate information services to the farmers.

Conclusion

There is no doubt that in both India and China, the government and national institutions recognize the growing importance of technology related information. Both countries liberalized and privatized their telecommunication sectors. Similarities also exist in the liberalization process in the telecom sectors of both countries such as the restructuring of government operators by increasing competition in mobile markets, allowing foreign direct investment in telecom equipment, and the creation of a telecom regulatory agency. However, the overall strategies for the growth of mobile phone services and telecom in general were different in the two countries.

India embraced full privatization, giving private owners the controlling rights to provide mobile phone services. This resulted in improved performance in mobile phone services in rural and urban areas. Full privatization increased competition, which led to increased foreign and private investments, network expansion, and a decrease in cellular call rates and equipment costs that made mobile phones easy to access.

In comparison to India's experience, China, in its own fashion, liberalized and introduced competition in the sector. China employed partial privatization by allowing foreign investment in telecom equipment that reduced the mobile phone device rates. Competition specific to providing mobile phone services was created through changes in industry regulations and dividing state-owned companies based on services provided (fixed-line, mobile phone, and satellite communications). However, the Chinese government has not been willing to give up the controlling rights to provide mobile phone services. The state-owned enterprises such as China Telecom or China Mobile remain the dominant fixed-line and mobile phone service providers. In both countries, the government's strategic policy changes created competition that lowered mobile phone prices and provided infrastructure and institutional support that increased the accessibility of mobile phones.

India and China recognized the importance of information in developing rural areas. Both countries developed programs and strategies for rural development in their five-year plans. Some of India's strategies included developing information infrastructure, providing universal service to all villages, and establishing information databases through work groups, business, and public institutions. Similarly, China developed an informatization policy plan, VAP, and other regional level programs.

Comparing India's IKSL and China's RIN mobile agricultural information service programs provides good illustrations of the implications of a government policy that employs private and public actors for growth versus a government policy that utilizes a wholly government agency. By looking at the programs, this study explains the different successes for the two programs – one based on collaborative efforts of public and private agencies and the other based on government agencies. The study reveals that the IKSL and RIN programs, with

the support of government institutions, show that information disseminated by mobile phones can facilitate farmers' development.

From a policy implication perspective, the thesis emphasis that a collaboration of private and public actors is more effective and allows information to be disseminated faster and more accurately. As seen in IKSL program, the program with collaboration of government agencies, private telecom operator and other actors grew subscriber rate at 37.47% in 4 years, from 2008-2012, versus China Mobiles RIN program that grew subscriber rate at 21.1% from 2007-2010. In developing countries, governments lack the financial resources to provide service programs and private agencies lack the reliable government information, so collaboration both parties to overcome the constraints and to create opportunities. The program under the partnership can be effective under the principles of accountability, transparency, and sustainability. This partnership allows all actors to share the responsibilities, risk, and profits. Either the government body or the private agency will be accountable and the beneficiaries (farmers in this case) will have more opportunity to voice their concerns. As there is more than one provider or program (e.g., Reuter Market Light or Life Tools) to choose from in a competitive market, the program providers would lose the customers if customer concerns were not considered or rectified. The partnership program also allows delivering information in a more cost effective and efficient manner than traditional ways like television and newspapers.

Limitations and Further Research

This research has studied the implications of the effectiveness of disseminating information for agricultural needs by comparing a private-public partnership against government-owned agencies. However, three important limitations should be acknowledged. First, a different methodology like a pilot study or survey in the field can be used for further investigation to better understand the accuracy and timeliness of the information sent to farmers.

Second, a significant obstacle is the lack of accurate and relevant data. It has been difficult to find comparable data on China and India. More statistical data on the programs and would have allowed for conclusions that have a greater degree of accuracy. The data on the RIN program is limited as it is provided by only one enterprise, and its success has not been studied like the programs in Africa or India. A need still exists for further evaluation of the RIN program's success. Third, the thesis studied mostly focused on the services such as voice messages and short text messages to farmers through mobile phones rather than mobile phone internet driven services. As 3G technology available in India and China, it would be interesting to see how farmers use mobile phones as computers in the field. Instead of going to computer based village centers to get information, a study that investigates on the use of mobile phones with internet service will explain further the reliability of the information sent.

Despite these limitations, this study may be considered as a preliminary work to investigate whether disseminating market information services in the agriculture or other field is successful with collaboration of public-private actors or wholly government actors. A future study may be studied based on using randomized controlled trail methodology. Here randomly selected treatment groups of farmers are provided information through mobile phones and controlled group of farmers have no access to mobile phones. This method may provide more accurate and reliable results on use of mobile phones and their effectiveness on development in agriculture or other sectors.

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