
Inclusive Innovation and Growth Based on a National Innovation System: Experience from China[†]

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Abstract

China is becoming a global hot topic because of its rapid economic growth. However, the country shows signs of not meeting the expectation of retaining its long-term industrial competitiveness and economic growth, especially with a widening rich–poor gap and natural resource exhaustion. Realizing inclusive growth requires study of an inclusive innovation solution. In this paper, we analyze the feasibility and development path of China’s inclusive innovation based on the framework of a National Innovation System, identify examples of inclusive innovation in China, and seek to provide policy suggestions for China’s future sustainable development.

Keywords

inclusive innovation, inclusive growth, national innovation system

1. INTRODUCTION

In the past 30 years, China has achieved rapid development, especially since 2000, and the average annual growth rate of GDP is over 10%. Meanwhile, China’s innovation activities in science and technology have progressed remarkably. Like many countries in rapid development phases, the rise of China mainly relies on the drive from technology-intensive products and export-oriented indus-

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trialization. However, the rapid-growth pattern has resulted in unexpected consequences such as the widening of the rich–poor gap and natural resource exhaustion.

Facing the challenge of sustainable development, the government of China has proposed to build a national innovative system and has developed many related policies focused on values of research and development, commercialization, and knowledge absorption to upgrade industry structure and to change the present pattern of excessive exploitation of natural resources. The effects are not satisfactory, however; the rich–poor gap is still widening, and Small and Medium Enterprises (SME) development issues have become increasingly prominent. Especially after 2008, because of the global financial crisis and industry transfer, China’s economic risk has increased considerably along with potential problems like expanding domestic demand and reducing unemployment, while the United States and other developed countries have focused on startup plans targeting relocation of manufacturing and R&D centers to domestic regions. In the future, satisfying the innovation demand of sustainable development will require adjustment of the ideas of government in design and implementation and greater involvement of innovation areas. Therefore, inclusive innovation is essential for achieving inclusive growth.

In the framework of a National Innovation System, this study was designed to identify a feasibility and development path for China’s inclusive innovation, analyze the states of inclusive innovation in China according to a case study, and attempt to devise policy suggestions for China’s future sustainable development. In addition, this study is expected to provide a useful reference for other government-led developing countries.

2. WHY INCLUSIVE INNOVATION?

The concept of inclusive growth was first created and advocated by World Bank and Asian Development Bank economists. In 2003, the World Bank proposed the inclusive growth issue in the report, *Globalization, Growth, and Poverty: Building an Inclusive World Economy* (Collier & Dollar, 2003). The Asian Development Bank proposed that inclusive innovation is a development process that generates broad-based participation and specifically reduces poverty and social exclusions (Chatterjee, 2005). Recent remarks by Chinese President Hu Jintao on inclusive growth have triggered speculation that Chinese policy makers were refining their perspective on development to include this concept. As President Hu said, inclusive growth means to spread the benefits of economic globalization and development among all countries, regions, and people and to realize balanced economic and social progress through sustainable development.

In our opinion, inclusive innovation that addresses the needs of persons with low incomes can be high or low technology and based on the efforts of governments, firms, non-government organizations, or individuals, even grassroots innovators with little formal education. The goal of inclusive innovation is inclusive growth, which means allowing people in different environments to participate in economic activity, contributing to economic growth and sharing the fruits of economic growth equally.

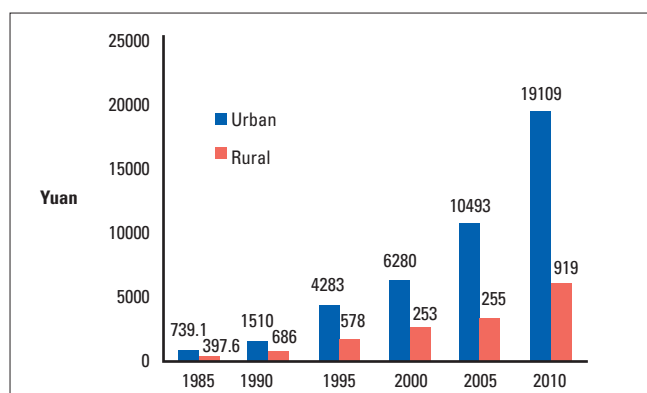
In China, with the development of reform and an opening-up policy, we have made significant achievement. However, we also found that the representation of agriculture in the whole economy has decreased, with large transfers of rural labor to urban areas and an expanded gap between the urban and the rural (Table 1, Figure 1, and Table 2).

TABLE 1. Income inequality is large

Indicators	China	India	Russia	Japan	Korea
GINI index ¹	41.5	36.8	42.3	24.9	31.6
Income share held by highest 10%	31.4	31.1	33.5	21.7	22.5
Income share held by lowest 10%	2.4	3.6	2.6	4.8	2.9

Source: World Development Indicator 2011

FIGURE 1. Rural–urban disparities in annual per capita disposable income (1985–2010)



Source: China Statistical Yearbook 2011

TABLE 2. Main index of agriculture & rural development

Emerging economies	Share of agriculture in GDP (%)		Rural population in total population (%)		Agriculture value added per worker (constant US\$ 2000)	
	1980	2010	1980	2010	1980	2009
Argentina	6	10	17	8	6615	9987
Brazil	11	6	33	14	1179	3760
China	30	10	80	55	191	525
Egypt	18	14	56	57	1366	3024
India	36	19	77	70	313	468
Malaysia	23	11	58	28	2791	6544
Mexico	9	4	34	22	2247	3231
South Africa	6	3	52	38	2012	3641
Thailand	23	12	73	66	399	725

Source: World Development Indicator 2011

Today, China's urbanization rate is 51.3% with a total population of 1.347 billion, of which 690 million are urban and 656 million rural. The rural areas have a large potential for consumption and technology innovation. Thus, rural development has been an important area for China's inclusive growth through achieving balanced development between urban and rural areas and between the economy and society at large, but it also remains a hard nut to crack. To sustain growth and reduce poverty, China must leverage and improve its innovation potential.

3. HOW TO IMPROVE INCLUSIVE INNOVATION AND GROWTH IN CHINA?

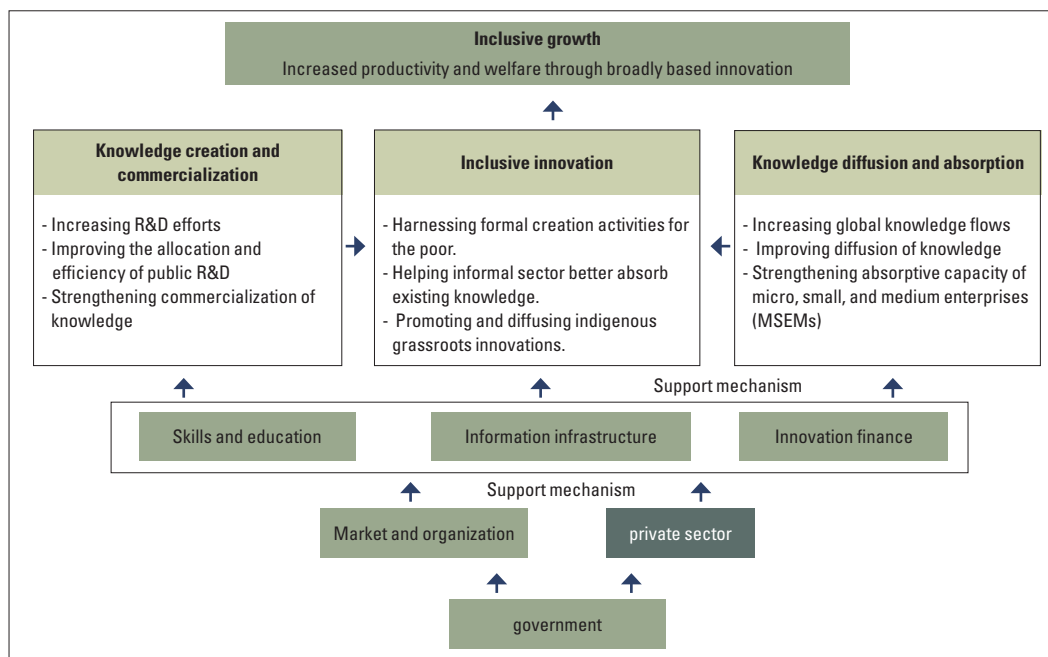
Here we will construct an inclusive innovation model under the framework of a national innovation system based on innovation factors and identify paths to realizing the goals. Furthermore, we analyze the feasibility of promoting China's inclusive innovation and growth under the current environment.

3.1. The Model of Inclusive Innovation

Innovation is broadly defined as offering "new knowledge creation and commercialization" to the world, as well as "new knowledge distribution and absorption" for the market. This definition not only includes "create and new knowledge" but also means applying existing knowledge in a new place with new people and new products. In recent years, the government has formulated a series of support measures to strengthen research and development and commercialization but remains unable to meet the needs of economic development. In addition, investment resources do not meet these needs.

Therefore, we need a new approach that could leverage the strengths of the public and private sectors in designing and operating innovation support programs, with a greater focus on inclusive innovation. The government's role should be to provide policy and a regulatory framework that encourages the private sector to undertake riskier initiatives that are economically beneficial but that such firms would not normally undertake. Creating a friendly environment society, developing higher education and vocational education in various forms, strengthening public infrastructure services and capital market and financial innovation – thereby promoting fairer and more intense competition – are critical to spurring innovation efforts. This framework should be complemented by financial and fiscal support where needed, with significantly more for poor and disadvantaged people (Figure 2).

FIGURE 2. Inclusive innovation model in China



Source: Author

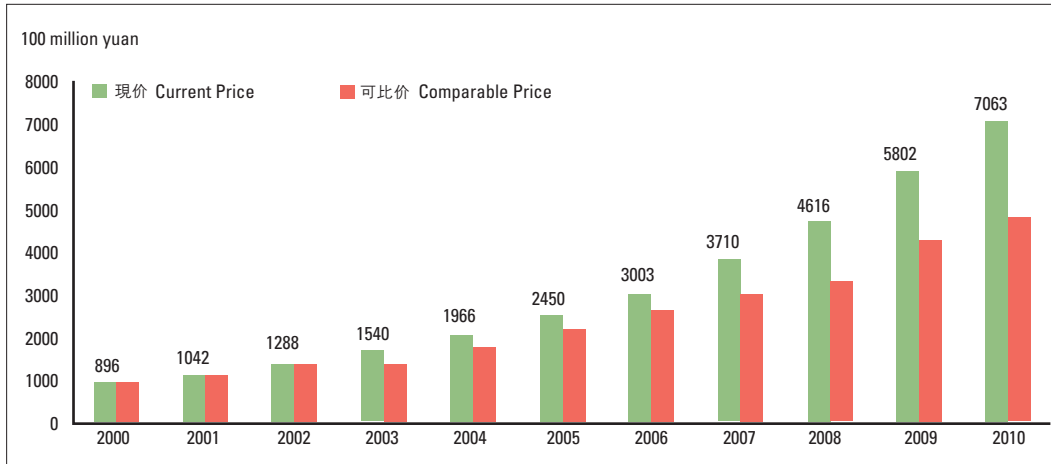
3.2. Feasibility Analysis of Inclusive Innovation in China's Innovation System

China has immense potential to implement inclusive innovation in the following areas. First, government is highly concerned about disparities and in recent years launched a series of policies and measures boosting the development of low-income people and a more-even playing field. For example, the central government has marked a shift from “pursuing economic growth” to “sharing the benefits of development by its all people” in its Twelfth Five-Year Plan (2011–2015). In the No. 1 government work report, the State Council further stressed support for agriculture, rural areas, and farmers, required increasing investment in science and technology in rural areas, and incorporated “the structural adjustment and upgrading of agriculture” into the Twelfth Five-Year Plan, encouraging the development of modern agriculture. Meanwhile, the government launched numerous programs to broaden access to basic public services for the disadvantaged, such as building a social security system covering both urban and rural residents, improving the basic medical security system, broadening branchless financial services channels in rural areas, and investing in western and low-income regions to modernize the rural transportation infrastructure.

Second, China has a well-developed innovation system. In 2006, China implemented build-up of its National Innovation System from the central government level and launched a series of projects and R&D investments that promote the rapid development of science and technology and enhance the links among government, enterprises, and universities (Figure 3). In 2010, China's R&D expenditure accounted for 1.76% of the GDP. China's patent applications reached 1,222,000, and invention patent grants reached 135,000, ranking No. 3 in the world. It had almost 130,000 SCI papers,

ranking No. 2 in the world, and its citations per paper jumped from No. 13 to No. 8. According to The Global Competitiveness Report (2011–2012), China ranked 29th out of 142 economies in terms of its innovation index.

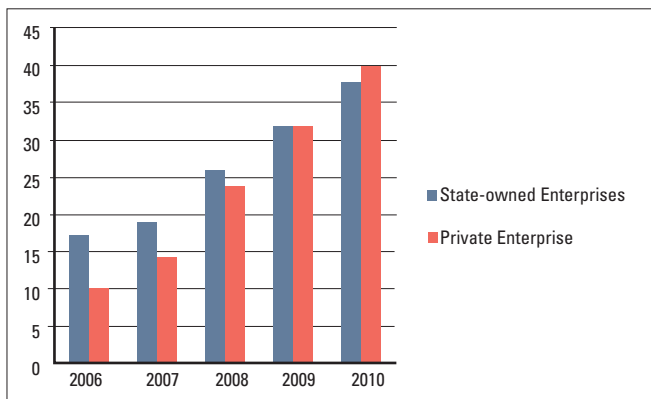
FIGURE 3. Gross domestic expenditure on R&D (2000-2010)



Source: China Statistical Yearbook 2011

Third, the private sector has undergone rapid growth. Chinese enterprises are climbing the technological ladder, and some are approaching the international technological frontier, such as Huawei and MediaTek in the Information and Communication Technology (ICT) industry, which brought large-scale and wide-ranging capabilities of manufacturing capacity and developed a high-quality information infrastructure. According to data, the number of invention patent applications of large and medium-sized private industrial enterprises dramatically increased from 1,885 in 2006 to 8,659 in 2010 (Figure 4).

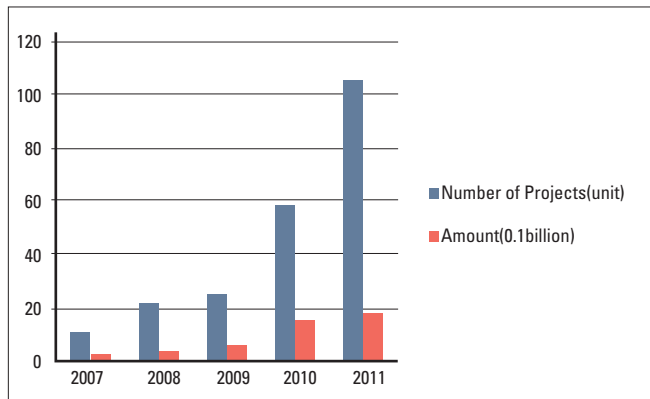
FIGURE 4. R&D expenditure by type of enterprise (2006–2010)



Source: China Statistical Yearbook 2011

Fourth, improving financial markets and boosting venture capital are both important. Since 2009, the government has encouraged initiation of an enterprise-led, diversified, multi-channel funding mechanism for scientific and technology innovation. In 2011, the number of venture capital institutions in China reached 1,096 while venture capital under management totaled RMB 319.8 billion, an increase of 32.9% over 2010, and the cumulative investment amount was RMB 203.66 billion, including investment in high-tech enterprises that accounted for 51.0%. Agriculture has become one of the fields for venture capital, increasing at its fastest rate over the last 5 years, with billions of funds in 2011 alone (Figure 5).

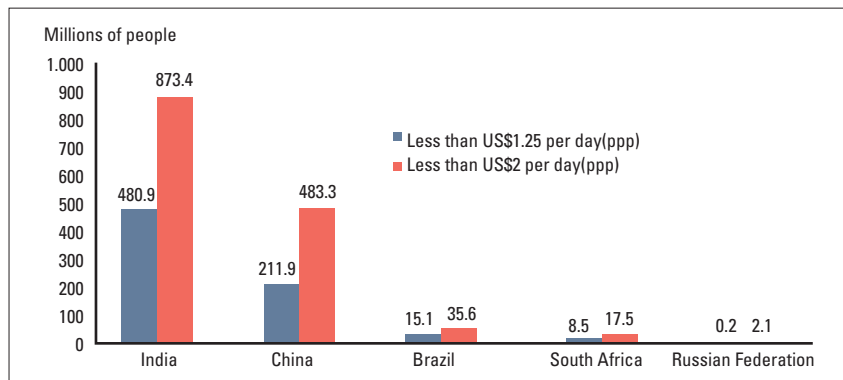
FIGURE 5. Investments in agriculture (technology) by projects/investment amount



Source: Venture capital development in China (2008–2012).

Last, China has a huge market and a large Bottom of Pyramid (BOP) market. In 2008, China's poverty headcount ratio at \$2 a day (PPP) accounted for 29.8%, over that of many developing countries. If we view it from a global perspective, more than 15% of World BOPs are in China (Figure 6).

FIGURE 6. BOP markets of main countries



Source: World Development Indicator 2011; the survey year is 2005 for China, India, Brazil, and Russia and 2006 for South Africa.

As we know, however, China also faces great challenges in some areas, including a lack of sufficient concern for the lower strata of the population, unfair competition between private sector and state-owned enterprises, lack of close correlation between poverty-reduction policies and innovation policy, and the integrity of the system framework.

4. CASE STUDIES OF INCLUSIVE INNOVATION

China has been concerned about the “agriculture, farmers, and rural” issues and SME issues for a long time and has accumulated some experience and achievements based on the efforts of government, private sector, non-government organizations, and individuals.

4.1. Government

The Chinese government has always attached great importance to the issues of farmer and MSEM development. With the emergence of rapidly growing rural non-state enterprises in the early 1980s and with the Chinese government’s determination to be more active in using S&T developed in China in the real sector, in 1986, the Ministry of Science and Technology initiated the nationwide Spark Program. Its overall objective was to help transfer technological and managerial knowledge from more advanced sectors to rural enterprises for supporting continued growth and development in non-state rural enterprises and to help increase output and employment. The program has spread to virtually every province in the country and has helped develop 57,000 projects during the “Eleventh Five-Year” period (2006–2010), with a total investment of about RMB 194 billion. As a result, over 20 million people have found employment in rural areas. The Spark Program has achieved one of the primary objectives of China’s agricultural and rural development policy, boosting many grassroots innovators, stimulating and modernizing the rural economy, and improving the living standards of farmers.

Meanwhile, the Chinese government has also promoted many other programs relating to agriculture and rural areas, such as the Torch Plan, Agricultural Science and Technology Park, Agricultural Science and Technology Incubator, Fund for Transformation of Agricultural Science & Technology Achievements, and the Special Fund for Top Counties Enriching People with Science and Technology. These programs not only provide funding that improves innovation infrastructure and accelerates technology transfer, knowledge diffusion, and absorption, but also they provide technology assistance and create a friendly environment for the non-high-income groups to try new ideas and gain wealth.

4.2. Public Research Institutes

For the past few years, China’s government has promoted enterprises, universities, and research integration constantly and deems it an ideal solution for technology transfer. With solid support from national policies, some emerging research and production organizations have been developed that provide high-tech products for the rural market, especially in healthcare and communication industries.

The Shenzhen Institutes of Advanced Technology (SIAT) was jointly established by the Chinese Academy of Science, Shenzhen municipal government, and Chinese University of Hong Kong in February 2006. As a very young and vigorous institute, SIAT engages in comprehensive and multi-disciplinary research in several divisions. One branch of SIAT, the Institute of Biomedical and Health Engineering (IBHE) is the key research division of SIAT, dedicated to developing innovative low-cost, miniaturized, integrated, networked, digitalized, and smart medical instruments. Using cloud technology, IBHE has developed a healthcare system designated as ‘Hai Yun’, which is a high-quality total solution of pharmaceutical and healthcare including terminal diagnosis equipment and a medical information management system. Patients in rural areas can get necessary treatment in their village, and rural doctors can enhance their capability of treatment with immediate medical support. Since March 2011, 248 village healthcare rooms have been created in Guangdong, Zhejiang, and Sichuan, among other provinces. According to the aggressive development plan, 630,000 healthcare rooms will be built and over 1,000,000 doctors will be trained in the near future. Undoubtedly, it is a large, deep market that can improve the healthcare situation of China’s rural areas profitably. In addition, Shenzhen Research Institute of Tsinghua University, the most famous university in China, has developed low-cost mobile phones for low-income farmers, a necessary communication tool of the IT age for improving their social networks.

In fact, China's university and research institutes can play a greater role in transformation of technology and society. According to incomplete statistics, the transformation efficiency of S&T achievements is very low, only about 10%. In the future, China’s universities and research institutions have much to do to promote the commercial application of S&T achievements, especially in developing the BOP market.

4.3. Private Sector

The private sector has the best capability and motivation to satisfy the demand of the BOP market. As the Fortune magazine described, the number of innovation activities from BOP is increasing daily. Efforts to develop products for the poor and underserved can create sustained business opportunities. China has a huge rural BOP market, and firms can use their considerable technological, organizational, and marketing capabilities to create and deliver products and services for people at the bottom of the economic pyramid and profit while doing so (Prahald, 2003). We take here as a case study Tsinghua Solar Systems Ltd. It is the patent owner of AL-N/AL solar selective coating, a revolutionary technology for China’s solar thermal industry. Compared with a typical family electrical heater, gas boiler, or coal boiler, the solar heater is much cheaper in cost, without pollution, and can be installed anywhere. So Tsinghua Solar has been a major brand in China’s rural market and changed farmers’ habits and customs. Another case is Shenzhen Kuang-Chi Institute of Advanced Technology, sponsored by industries, government, and venture capital. The Institute was founded by Shenzhen People's Government, Mindray Ltd., Shenzhen Research Institute of Tsinghua University, Green Pine Capital Partners Co. Ltd., and the leading team of the Kuang-Chi Institute in 2009. The mission of Kuang-Chi Institute is to conduct breakthrough science with broad applications, execute cutting-edge technology to make dreams a reality, and bridge the gap between science and human life. In 2012, Kuang-Chi developed the first Meta-RF panel satellite antenna in the world to successfully receive a TV signal. It can be mounted on the wall like a picture or a

framed painting. Compared with a traditional dish antenna, the Kuang-Chi Meta-RF antenna is elegant in appearance and resists wind, rain, and snow. More important, the cost can be lowered than traditional antenna by 60%. With government support, Kuang-Chi Meta-RF antennae are now used in 21 cities and 15 provincial-level regions, which can greatly improve the rural infrastructure construction conditions.

The government should consider allocating more funds to encourage formal creation and commercialization efforts that focus on the challenges facing the poor. For example, a Pilot Inclusive Innovation Fund can be established to support formal R&D aimed at the needs of the low-income people.

4.4. NGOs in Action

In modern China, NGOs have played a more important role in the development of socially vulnerable groups than ever before. Xiao Dai, which means ‘small loan’ in Chinese, is a network payment platform of mutual funds, sponsored by the Beijing Agricultural Development Foundation for Poverty Alleviation. As an innovative loan model targeted to low-income farmers, the small loans network draws on the microfinance model created by Muhammad Yunus, the Nobel Peace Prize recipient, and has operated for 18 years. Online through Xiao Dai, one can lend a small amount at a minimum of RMB 50.25 (0.25 RMB is the handling fee) to the farmer of their choice. Using an international popular micro-credit risk control system, the Xiao Dai website sets up a special risk reserve account for the investor (lender). Also, to secure the repayment, a five-family warranty group from the same village is required for every borrower, and each loan must pass a strict audit process. To date, the project has provided service for 70,000 families in 429 villages of Hebei and Henan provinces. More than 300,000 people, mainly rural women, have benefited from using the Xiao Dai website. The small loans helped them climb out of poverty, take care of children and the elderly, and boost the development of the rural economy. In 2011, the repayment rate of Xiao Dai was almost 100%.

4.5. Brief Summary

From the cases above, we have analyzed the states of inclusive innovation in China from the perspective of participation that covers health, communications, and other infrastructure, as well as the diffusion of technology, financial, and fiscal supply for low-income people. On a large scale, it has more and more participants who have begun to pay attention to inclusive innovation and inclusive growth (Table 3), which should garner more attention and support from the government.

TABLE 3. Inclusive innovation: activities and actors

Sector	Knowledge creation and commercialization	Knowledge absorb and diffusion	Improving infrastructure and quality of life	Increasing financial support	Improving labor skill
Government	National High-tech R&D Program, Key Technologies R&D Program, National Basic Research Program of China, Spark Program	Spark Program, Agricultural Science and Technology Park	Spark Program, Torch Plan, promote R&D of traditional medicine, organize pilot project	Fund for Transformation of Agricultural S&T, achievements	Spark Program, build public education platform
Public research institutes			Low cost medical care equipment, low cost and low energy CPU		
Private sectors			Low-cost heating equipment, affordable electricity bicycle	Online finance service to the SMEs	Low-cost distance-learning services
NGO				Small loan program for farms	

Source: according to relevant data collection

5. CONCLUSIONS AND SUGGESTIONS

In sum, inclusive innovation is a complex system of work that requires collaboration among government, private sector, universities and research institutes, NGOs, and even individuals. Meanwhile, issues remain to be solved in the framework of an innovation system.

First, it's the scope of innovation. We mainly focused on research and development at the forefront of technology and innovation but lacking initiatives targeting innovation diffusion and commercialization.

Second, it's about distribution mechanism. Although many resources are available for inclusive innovation, the distribution mechanism is not adequate, and the efficiency is thus very low.

Third, Support method. Competitiveness of innovation for rural products and service arises from new ideas, technology, process, and methods, but currently it depends mainly on financial subsidies, which are not tenable for sustainable development.

Fourth, government role. In China, government always plays the most important role in inclusive innovation, sometimes even the only important role, and there is a lack of participation from the private sector, R&D institutions, multinational companies, and NGOs. Collaboration and interac-

tion between government and other actors should be encouraged.

In the future, led by government, we need to build a more comprehensive and diversified inclusive innovation network based on a national innovation system, following these main suggestions:

First, raise public awareness of inclusive innovation. Considering the value chain of the entire social system, inclusive innovation can be deemed a key factor for the national innovation system and sustained economic growth. Government should change the mode of thinking to focus not only on reducing the cost of goods and services for the poor but also on providing technical assistance to support knowledge diffusion and gains in wealth for low-income groups; meanwhile, government should promote policies to encourage collaboration and innovation of participants.

Second, we should effort to create a favorable and friendly business environment. Government should maintain a strong supply of public goods, strengthening infrastructure construction, enhancing high-quality education and skills-training services, and improving the investment climate. Creating fair opportunities and a competitive environment for all the people is important.

Third, promoting the efficient allocation of financial and fiscal resources. Government should add a new inclusive innovation factor to annual performance goals and promote the effective flow of resources. On the supply side, government can launch an Innovation Fund of Funds and act as the angel investor to advance the effective financial and fiscal policies for spurring market and promoting inclusive innovation. On the demand side, government can use procurement to promote inclusive innovations, for example, by specifying goods and services for the poor and encouraging competitive bidding to produce them, thereby generating a market of inclusive innovation.

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