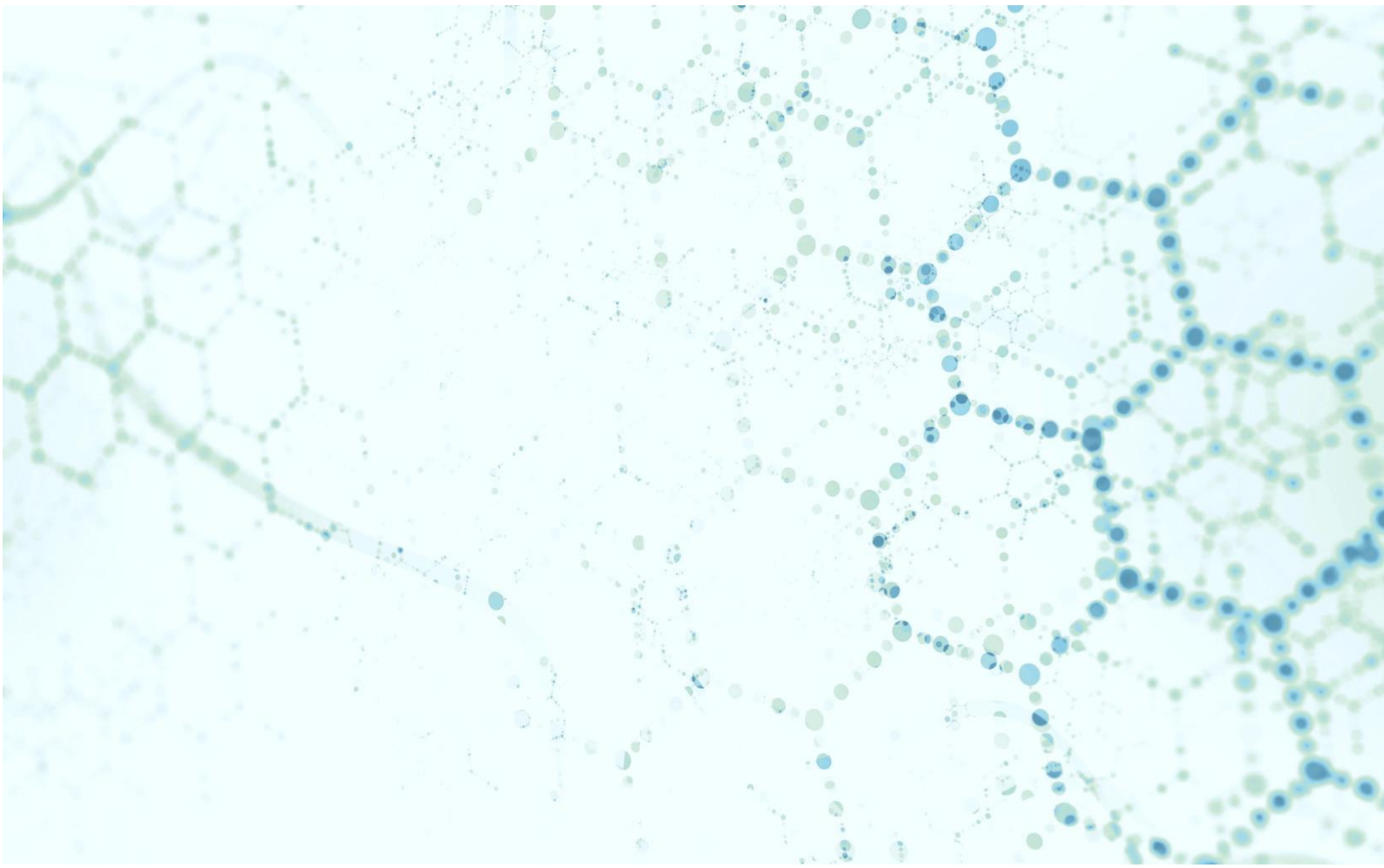
Overview of Inclusive Innovation Policies in the People's Republic of China



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OVERVIEW OF INCLUSIVE INNOVATION POLICIES IN THE PEOPLE'S REPUBLIC OF CHINA

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The authors are researchers at the Chinese Academy of Science and Technology for Development (CASTED), a research institute directly under the Ministry of Science and Technology of the People's Republic of China (MOST). CASTED primarily conducts research on national science and technology (S&T) development strategies, policies, mechanisms, management, foresight and assessment, as well as facilitating social and economic development through S&T. It provides consulting services in macro decision-making processes for national S&T, economic and social development. Since 1982, CASTED has participated in important policy studies and decision-making for national S&T reforms and development. It also organised or participated in many research projects on key national programmes and on regional development strategies or plans. With its active consulting and pioneering work, it has boosted the systematic reform and the development of the People's Republic of China's S&T. CASTED has established an extensive research network on S&T policy at home and abroad, and it co-operates with the outside world in conducting international research projects, setting up mechanisms for long-term international academic exchange, and organising international academic conferences. The research for this paper is funded by MOST's Department of International Co-operation.

SUMMARY

This report presents an overview of the People's Republic of China's (hereafter "China") inclusive innovation policies. Inclusive innovation is defined as the development and implementation of new ideas that can enhance the social and economic wellbeing for low-income, vulnerable and marginal groups. This includes innovation to benefit these groups and innovation by these groups. While the Chinese government has never officially adopted a policy to promote inclusive innovation, since 1978 China has adopted many initiatives to that have promoted inclusive innovation including policies for i) public wellbeing, ii) agricultural and rural development, iii) regional development, iv) industrial development, v) small and micro enterprises, and vi) grassroots innovation. Since 2002, China has promoted the idea that scientific and technological innovation is important to improve the social and economic wellbeing of its citizens. However, China still faces important challenges, such as the large share of population with low income, large income gaps and inequalities as well as unequal access to public services. Consequently, inclusive innovation in China remains highly relevant.

First, regarding specific policy approaches, to improve **public wellbeing** science & technology (S&T) innovation in China is now entering a new stage, in which economic and social development policies are more coordinated, and benefits from China's economic growth are expected to be increasingly shared with marginal groups and underdeveloped areas of the country. The 12th Five-Year Plan on National Economic and Social Development (2011-2015) emphasised supporting fields related to people's livelihoods, including natural resources and the environment; health care; urbanisation and urban development; disaster prevention and mitigation; and public safety. To achieve this, the government designed and implemented S&T development plans, major S&T projects, and pilot and demonstration projects.

Second, regarding **agricultural and rural development**, since the 1980s China has carried out the Poverty Alleviation by S&T Programme to increase farmers' income in rural areas. This programme comprises several actions, including promoting advanced applicable technologies, building S&T service systems in rural areas, and providing S&T training to enhance the capacity of farmers to innovate. In addition, in the 1990s the government explored a service called S&T Envoys in rural areas, which aimed to empower farmers to participate in innovation, thereby increasing their income.

Third, to encourage **regional development**, China has launched major strategic programmes that use S&T to support the development of various regions in the western part of the country. Progress was noted both regarding economic and social development.

Fourth, regarding initiatives in the field of **industrial development**, the "inclusive" dimension is reflected in the promotion of emerging industries. Such initiatives include top-down programmes that aim to find solutions to societal challenges, e.g. the Chinese government's the research and development (R&D) initiative for low-cost antimalarial drugs in the 1960s. Bottom-up innovation also contributed, including with the development of low-cost innovations in the Chinese mobile telephone industry. However, the development of such emerging industries needed governmental support in sectors where high entry barriers in terms of scale and technology exist. For this reason, as an example, the Chinese government launched the Golden Sun Project to promote the development of the photovoltaic industry.

Fifth, China also encourages **SMEs and micro-enterprises** to become more competitive via providing pilot conditions and funding. For example, the Chinese government established the Spark Plan in 1986 to foster rural enterprises and promote technology upgrades by them; the Innovation Fund for SMEs in S&T in 1999 to support initial-stage businesses; and the Transformation Fund for Agricultural S&T Outcomes in 2001 to support the development and transformation of S&T outcomes in the agriculture and forestry fields.

Sixth, **grassroots innovation** has also been encouraged in China by policies aimed at supporting S&T education in rural areas through programmes such as S&T for Rural Areas and Farmers, STI Laboratory for Country Teenagers, Poverty Alleviation by Education and others. The government also promotes grassroots innovation through the provision of S&T services such as innovation incubation, financing loans and technical consultations. In this case, China's grassroots groups – including blue-collar workers, the unemployed, farmers, college students and teenagers – have created a series of inventions, which not only create economic value but also bring about social benefits.

Despite these many practices in inclusive innovation, there remain barriers to overcome. Sustainable development of inclusive innovation in China requires ensuring that the idea of inclusion remains central to innovation policy.

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1. Introduction: inclusive innovation policy in China

Although never adopting inclusive innovation officially as a policy, since 1978 China has done much to promote public wellbeing, agricultural and rural economies, regional development, industrial development, small and micro enterprises, and grassroots innovation. This series of actions matches well with the nature of inclusive innovations, which can be defined as new ideas that can enhance social and economic wellbeing for marginal groups in society. This can be viewed from two aspects: one is innovation for marginal groups; the other is innovation by marginal groups, which is also known as grassroots innovation (OECD, 2012). This report adopts this definition, by discussing innovation policies aimed at supporting low-income, vulnerable and marginal groups as well as policies aimed at enabling more innovation in rural areas, emerging industries and small and medium-sized enterprises (SMEs).

Beginning in 1978, China's economy began to grow as the government carried out comprehensive reforms, moving toward a market economy model. Until the 1990s, the government mainly concentrated on rebuilding infrastructure and building the production infrastructure. After more than a decade of development, China's economy had developed rapidly and people's living standards had improved significantly. While inclusive innovation was not prioritised as part of government priorities, some important policy efforts were undertaken in the area: the central and local governments conducted a series of inclusive innovation exercises to use S&T to alleviate poverty. In some cases, mature, advanced and applicable technologies were introduced to rural areas and farmers were given training to increase their income. In other cases, traditional entrepreneurs of regional products were promoted as a way to boost the rural economy.

From the 1990s to 2002, China put forward the policy of prioritising "efficiency first and then fairness". During that period, China experienced substantial economic growth. In 1991, China registered an annual GDP growth of 8.0%, up from 3.9% in 1990. Growth accelerated even more after Deng Xiaoping's southern tour speech in 1992, in which he said that it was necessary to promote reforms and to open the economy; that year, real GDP growth was 13.2%. Furthermore, the 14th National Congress of the Communist Party of China (CPC) held in the same year explicitly suggested the idea of creating a socialist market economy as a means of accelerating economic development, stimulating investment enthusiasm and improving the next year's economic conditions. The Third Plenary Session of the 14th Central Committee of the CPC held in 1993 presented an income allocation system "giving priority to efficiency with due consideration to fairness," which to some extent neglected the interests of marginal groups, resulting in a widened income gap. During this period, the central government allocated its limited resources to major innovation projects, paying less attention to innovations that would directly promote people's wellbeing. Inclusive innovation initiatives mainly focused on agricultural science and technology transformation, along with science and technology support for SMEs.

Since 2002, China has explicitly promoted the idea that scientific and technological innovation would be an important strategy for improving wellbeing. In 2002, the 16th National Congress of CPC put forward, for the first time, "social harmony" as an important goal for the country. "Paying attention to social justice" was proposed in the Fourth Plenary Session of the 16th Central Committee of CPC. The outline of the National Programme for Medium and Long-Term Scientific and Technological Development (2006-2020) identified agriculture, environment, health and livelihoods as priority themes. The 12th Five-Year Plan for the Development of Science and Technology of China states that the country must first use science and technology to benefit people's welfare; second, connect scientific and technological progress and innovation with improving people's living standards and quality of life, and raise the scientific and cultural qualities of the population; and third, strengthen the application of advanced scientific and technological achievements to promote the popularisation of

science and technology. In this context, MOST and other departments have introduced a series of policies to promote the development of science and technology to improve public welfare, such as the S&T Programme for Public Wellbeing. Meanwhile, local governments are actively attaching importance to improving livelihoods through innovation. At the same time, workers, the unemployed, peasants and other grassroots groups are becoming increasingly active in terms of innovation, creating economic and social benefits.

1.1. Characteristics of inclusive innovation

As with other types of innovation, inclusive innovation promotes the realisation of new ideas through innovation in products, services, processes, organisation and marketing. Inclusive innovation also has unique characteristics, mainly reflected in the following:

- Inclusive innovation focuses on providing innovative products to or encouraging participation in innovation practices by low-income and marginal groups that cannot get the same economic and social benefits as other members of the community due to economic, geographic, social and other structural barriers. As a result, inclusive innovation improves the welfare of society as a whole.

- It creates opportunities for marginal groups to obtain and enjoy innovation outcomes and participate in innovation activities. Making sure everyone can benefit from innovation reflects the fairness of inclusive innovation as well as the inherent requirements for social justice.

- Because of the lack of resources, marginal groups tend not to buy expensive, flashy innovative products or services, or to be involved in higher-cost innovation activities. Therefore, innovative products and services for marginal groups should be both of high quality and low cost. Moreover, the techniques and tools provided to them should also be low in cost and easy to access.

1.2. Need for inclusive innovation in China

There are several reasons why China aims to encourage inclusive innovation. A high proportion of China's population is poor. These bottom-of-the-pyramid groups do not share the results of the country's economic growth over the past decades. According to World Bank statistics, in 2009 there were 365 million people in China living below the poverty line (i.e. with no more than USD 2 a day), making up one-seventh of the total global population in poverty. As shown in Table 1, the poverty rate in China was 27.2% in 2009, lower than in India and South Africa but much higher than in Brazil and Russia. This increases the challenge for China to carry out inclusive innovation to share the economic and social benefits of its growth with low-income groups.

Table 1. Poverty indicators for BRICS countries (2011)

	People's Republic of China	Brazil	India	Russia	South Africa
Population（millions）	1 344.1	196.7	1 241.5	143.0	50.6
Ratio of rural population in total population (%)	49	15	69	26	38
GDP per capita (current USD)	5 447	12 576	1 534	13 284	7 943
Poverty headcount ratio at USD 2 a day (PPP) (% of population)	27.2	10.8	68.8	0.1	31.3
Poverty headcount ratio at USD 1.25 a day (PPP) (% of population)	11.8	6.1	32.7	0.0	13.8

Note: Poverty headcount ratios at USD 1.25 from 2009; poverty headcount ration at USD 2.00 from 2009 except for India, which is from 2010

Source: World Bank database, http://data.worldbank.org/indicator

In addition, income inequalities in China are widening. According to data from China's National Bureau of Statistics, China's 2013 Gini index was 0.473, reflecting a relatively high level of inequality according to international standards. In 2009 the share of income held by the top 20% in China was 47.1%, while the share of income held by the bottom 20% was only 4.7%. Meanwhile, China's urban-rural income gap has been increasing year by year, from 1.85 in 1985 to 3.23 in 2010. This prompts the Chinese government to improve the economic welfare of low-income groups through inclusive innovation.

Low-income groups are at a disadvantage not only in the economic system but also in their access to basic public services. Differences in access to public health services in rural and urban areas are an example: in 2011, the number of urban health technicians per thousand people in China reached 14.19, and the number of beds in urban medical institutions was 6.24 per thousand people; however, the numbers in rural areas were only 5.5 and 2.8 per thousand people, respectively, less than half the numbers in urban areas (Chinese Health Statistics Yearbook 2012). These gaps require that living conditions and the quality of life in rural areas be improved.

1.3. Inclusive innovation for social development

Inclusive innovation is not only a driving force for economic growth, but also for social development and social justice. Development in China faces many challenges, such as environmental pollution, lack of resources, and inequality of social development. Beginning in 2006, China has relied on S&T to protect and improve livelihoods, and the evolution of science, technology and innovation is moving toward a new stage of promoting the co-ordinated development of the economy and society, and sharing growth outcomes with marginal groups and underdeveloped areas. The S&T programmes in areas of social development have witnessed a gradual rise, and the S&T expenditures on improving livelihoods have stably increased. Consequently, the conditions for inclusive innovation are improving, with an increasingly closer combination between S&T and inclusive growth.

China has developed a guiding framework, called the Action Deployment Framework, to foster inclusive innovation in China's social development area. It includes development plans, S&T programmes and special actions, determining both the basic direction and the action plans for science, technology and societal development for specific periods. Among various items, special attention has been given to the control and governance of water, the cultivation of new varieties of genetically

modified organisms, the creation of new drugs, and other areas that are closely related to wellbeing. The Framework has also established public security, climate governance, disaster prevention and diminution, and energy conservation as priorities for development.

This emphasis on social development is reflected in R&D funding levels. Figures from the National Key Technology R&D Programme (from 2008 to 2012) show that R&D expenditure on energy, resources and the environment accounted for between 14% and 20% of total R&D spending. The figures were between 9% and 11% for population and health, 7% and 12% for public security and other social affairs, and 5% and 5.6% for urbanisation and urban development. The sum of the above expenditures accounts for more than 40% of total R&D funding. Meanwhile, during the 12th Five-Year Period (2011-2015), four of the ten key civil S&T projects carried out by the state were related to social development – control and governance of water pollution; cultivation of new varieties of genetically modified organisms; invention of new drugs; and prevention and cure of major infectious diseases such as AIDS and viral hepatitis – that directly contribute to improving people's lives and the environment.

Many S&T policy-guiding projects and their implementation have provided opportunities for sharing innovation products among poor groups, and have explored the considerable potential of marginal groups and underdeveloped areas to adopt new ideas, techniques and processes. For example, MOST's S&T Programme for Public Wellbeing, launched in 2012, demonstrated technologies that could be applied immediately in poor areas to improve residents' quality of life. Such demonstrations have promoted the adoption of many advanced technologies. This programme seeks to promote the healthy development of the population, and improve conditions related to the environment, public security, disaster prevention and diminution, public services, and other areas about which the masses care most. In 2012, the total amount invested in the S&T Programme for Public Wellbeing accounted for about RMB 1 billion.

1.4. Achievements to date

China's inclusive innovation to promote social development covers a wide range of areas whose products directly serve ecological development and the improvement of people's livelihoods. This plays a supporting role in building a social-harmonious China. Among all these areas, the most important include resources and the environment, population and health, urbanisation and urban development, disaster prevention and diminution, and public security (Box 1).

The inclusive innovation actions in social development have already produced preliminary outcomes. For instance, by the end of 2014, the S&T Programme for Public Wellbeing has encouraged the input of RMB 6.5 billion from local governments, enterprises and society, and has resulted in the dissemination of more than 470 technologies benefitting 51 million people. It has also used more than 100 000 pieces of innovative medical equipment and products as demonstration products. The implementation of innovative S&T projects has promoted the research, systematic integration, and commercialisation of coal gas and biomass gas, which have contributed to reducing haze, and promoted the fast development of a clean gas industry. The demonstration of comprehensive governance relative to water pollution in major valleys such as Songhuajiang, Haihe and Huaihe has reduced chemical oxygen demand by about 10%.

Box 1. Key areas to promote social development

Resources and environment

- The National Programme for Medium and Long-Term Scientific and Technological Development (MLP) has identified energy, water and mineral resources, and the environment as being among the key national priorities. MLP objectives include "energy saving in industries" and "the control and governance of water pollution".

- During the 12th Five-Year Period, the National Key Technology Research and Development Programme assigned priority to ecological protection, with projects involving the restoration and re-construction of degraded ecological systems.

Population and health

- The MLP has listed population and health as an important area, defined five priorities including "the prevention and cure of frequently occurring diseases in urban and rural communities", and supported two projects directly, namely, "the invention of major and new drugs" and "the project of the prevention and cure of major infectious diseases like AIDS and viral hepatitis". First progress has been made in the invention of effective, low-cost drugs.

Urbanisation and city development

- The MLP has listed for the first time "urbanisation and city development" as a key area, and has defined five prioritised subjects, including "regional urban planning and its dynamic monitoring".

- In Huaming Town of Tianjin, the project for the "comprehensive demonstration of S&T for the masses" has provided convenient and highly efficient services for residents covering community, public security and health care objectives.

Disaster prevention and diminution and public security

- The MLP has also listed "public security" as one of the 11 key areas, and has defined 6 prioritised subjects, namely, an "emergency information platform for national public security", "warning and rescue of major accidents in production", and "food safety and entry-exit inspection and quarantine".

- Progress has been made in research on key technologies and equipment for professional risk prevention. For example, an experimental detection system against dust and toxic gas, as well as highly efficient and low resistant material used in prevention masks made of filtered and compound materials have been developed.

- A new breakthrough has been made in technology for fast testing "lean meat". New products like testing re-agents for high-throughput electrochemical microarray chips have also been spread. These will help to build a comprehensive ("from farmland to dining table") fast monitoring system for China's food safety at a basic level.

2. Poverty alleviation

In recent years, disposable income has been three times higher in urban areas than in rural areas. This gap is far above the global average, according to the World Bank. To break this dual structure as soon as possible and foster inclusive innovation, it is crucial to promote economic development in poor areas by relying on S&T, and to introduce advanced factors of production to rural areas. China's efforts to alleviate poverty in rural areas include reforming the closed peasant economy model by

improving farmers' scientific knowledge and usage and improving resource development and labour productivity.

2.1. Science and technology for poverty alleviation: history and achievements

The work of science and technology for poverty alleviation in China began in the 1980s, and can be divided roughly into five phases.

First phase (1980-1985): Rapid growth of China's economy driven by economic reform in rural areas directly promoted poverty alleviation in those areas. China also began to develop poverty alleviation and development projects. The former National Science and Technology Commission, as well as the former Provincial Science and Technology Commission of Hebei, had organised S&T centres in poor counties in the Taihang Mountains Area (Shanxi province) to promote the adoption of innovations. Within five years the centres had helped to greatly increase the per capita income in this development zone. This type of small-scale, indigenous exploration opened the door for S&T to contribute to poverty alleviation.

Second phase (1986-1993): In this phase, China witnessed changes in its poverty alleviation policy. The state council established an expert group to develop a national programme for the economic development of poor areas. As part of this programme, a number of specific S&T measures for poverty alleviation were identified, particularly to address the lack of sufficient food and clothing in poor areas.

Third phase (1994-2000): The Seven-Year Priority Poverty Alleviation Programme, a programme designed to lift 80 million people out of absolute poverty in a period of seven years, called for a strategic poverty alleviation plan based on S&T to improve farmers' incomes and quality of life. Subsequently, the emphasis was shifted from getting farmers out of poverty to supporting the development of pillar industries in poor areas. An incentive mechanism was created to encourage S&T personnel to actively participate in poverty alleviation programmes.

Fourth phase (2001-2010): In 2007, China proposed for the first time to establish a social security system for minimum living standards in rural areas. Since then, China's poverty alleviation work has combined social security and economic development programmes. The development of enterprises was fostered as a way to increase in farmers' incomes.

Fifth phase (2011-2015): As the size of China's low-income population has increased to 128 million and the number of areas affected by poverty remains important, the task of alleviating poverty has intensified. The focus of S&T for poverty alleviation has shifted from providing food and clothing to poor residents to promoting grassroots entrepreneurship that builds on efforts to improve supply of food and clothing, improves the environment, and narrows development gaps between poor regions and the rest of the country.

Over nearly 30 years' of poverty alleviation efforts, several methods have been developed based on providing demonstrations and training to China's poor in the use of innovations, as well as in providing S&T services. These methods have helped accelerate the pace of poverty relief and to promote wealth creation and self-development in poor areas. The experience shows that S&T for poverty alleviation is an important method for developing poor areas. With constant adjustments in objectives, working style and deployment, the mechanism of S&T for poverty alleviation is maturing.

The breeding industry is a good example. Priority was given to expanding the breeding industry and improving its efficiency, thereby increasing output while using fewer resources. This helped to

solve food and clothing shortages in poor areas. In turn, "pillar" industries were identified and developed in specific areas, creating regional economic growth centres around which other industrial chains developed. These centres also created platforms for communication and co-operation around the development and adaptation of innovation.

In addition, other kinds of S&T services have been provided in rural areas. These include disseminating information in rural areas about poverty alleviation efforts and programmes; helping rural areas establish an information-sharing platform for technology trade; building a co-operation between poor and developed areas; and promoting the development of private, non-governmental S&T service intermediaries. The development of farmers' organisations in poor areas has also been supported in order to promote the adoption and use of modern agricultural methods.

S&T for poverty alleviation has strongly supported the promotion of agriculture in poor areas and the sustainable development of rural areas. This has included guiding poor areas to formulate a long-term and scientific plan for poverty alleviation so as to carry out sustainable development over the long run. In addition, S&T has contributed through the research and demonstration of key environment protection technologies such as energy saving technology, clean energy technology, and eco-governance technologies to support sustainable development in poor areas.

In addition, S&T awareness and training have been promoted, and self-development abilities in poor areas have been improved. According to incomplete statistics, the number of S&T personnel participating in S&T for poverty alleviation in poor areas had increased from 3 525 persons per province in 2001 to 6 470 persons per province in 2008; the number of S&T envoys had raised from 35.75 persons per province in 2001 to 281.8 persons per province in 2008; the number of information service stations in rural areas had increased from 414.75 per province to 1 612.8 per province; and the number of imported S&T specialists also had increased from 414.75 persons per province to 1 202.2 persons. The content of the S&T for poverty alleviation work has been extended from the previous focus on training to use applicable technologies to professional training for farmers and talent building in general; from traditional face-to-face training to online education; and from the training of S&T leaders in rural areas to human resources development in rural areas. Statistics show that the average number of years of education for rural labourers in poor areas had increased from 7.0 in 2001 to 8.8 in 2008.

2.2. The "S&T envoy system"

The "S&T envoy system" is a system that encourages innovation among rural populations. In order to resolve problems in agricultural development such as poor-quality produce that is difficult to sale, Nanping City of Fujian Province launched an innovative practice in 1999. In this practice, a large number of highly qualified S&T specialists were encouraged to go to the frontline of agricultural production and to form a community of interest with farmers so as to provide them with S&T services including demonstrations, training and consulting, and gradually to form a new network of S&T services that meets the requirements of a market economy. According to the estimates of Nanping City, villages with S&T envoys increased the share of agricultural output as a result of technological improvements. Meanwhile, farmers' incomes in the villages with S&T envoys increased more rapidly than in villages without envoys: farmers' net income per capita in villages with S&T envoys witnessed an increase of 10.27%. MOST fully approved the practice in Nanping City, and later launched pilot projects in several other areas. On the basis of the results, MOST and then the Ministry of Human Resources (later Ministry of Human Resources and Social Security (MOHRSS)) jointly decided in 2005 to popularise this system nationwide.

During the past ten years, the system of S&T envoys has been improved steadily in China, with the extension of S&T envoys throughout the country. From east to west, from the early pilot projects in Nanping and Ningxia to projects in newly developed Zhejiang and Guangdong, different kinds of working models have been explored, respecting local conditions. Specifically, the development of China's S&T envoy system can be divided into the following four stages:

The exploring stage (2002-2003): In May of 2002, MOST decided to establish the first pilots of an S&T envoy system in three provinces and two autonomous regions in northwest China. To better manage the work of S&T envoys, MOST set up an office for envoy pilots. During that period, the S&T envoys in pilot areas began to focus on utilising financial tools – including rural credit co-operative services - in their work to promote the project's success.

The pilot expanded stage (2004-2007): The orientation of the S&T envoys' tasks switched from agricultural technology services to leading farmers to set up as S&T entrepreneurs. With the development of entrepreneurship, the pilot areas of S&T envoys were extended and the number of envoys was also increased. By 2007, the pilot areas covered nearly 1 040 counties in 31 provinces nationwide, and the number of S&T envoys had risen to 57 000, serving more than 14 million farmers in about 40 000 villages.

The innovative development stage (2009-2011): S&T envoys were encouraged to set up businesses in agricultural development, and at the same time to promote "entrepreneurial action" throughout the country with the support of an improved S&T service system in rural areas. Combined with increasingly S&T-savvy residents in rural areas, entrepreneurial action was gradually extended from agriculture to industry, and from rural areas to urban areas.

The institutionalised development stage (2012 to the present): In this period, the structure of China's S&T envoy system changed. According to statistics, S&T envoys from public institutions account for 44.82% of the total, those from enterprises account for 16.13%, university students account for 9.28%, and 16.22% are specialists in rural areas. About 44% of S&T envoys engaged in paid services, including technology, technical contracting, venture entities and other activities.

Up to September 2013, there were more than 700 000 S&T envoys working at the grassroots level in rural areas and in the frontline of agriculture, among which were 38 000 enterprises or institutes, more than 50 000 common interest communities, and more than 15 000 enterprises with 4 700 leading enterprises. These envoys have implemented 45 000 S&T development projects and earned more than RMB 40 billion in profits. In addition, 35 000 associations and economic co-operative organisations have been established, covering 4 609 000 members; a second group of 113 entrepreneurship chains has been established at the national level, with the establishment of 115 entrepreneurship bases and 81 entrepreneurship training bases; 61 000 new technologies and 68 000 new varieties of products have been imported; 9 373 training bases for S&T envoys have been created, there are now 8 124 information platforms on S&T entrepreneurship, 1 907 demonstration and communication platforms, and 16 000 S&T envoy serving stations have been set up. As a result, more than 60 million farmers have seen their incomes increase by adopting S&T.

This has been a product of five initiatives. First, a new S&T service system with the support of S&T envoys has been formulated. In recent years, all kinds of S&T service models have emerged in rural areas with the active engagement of S&T envoys, including experts' compounds, S&T demonstration zones, and information and technological co-operative organisations such as the "agricultural-technology 110 information service".

Second, new S&T service models that adapt to the development characteristics of rural areas have been created. This includes S&T intermediary services, technology shares funds, paid employment by enterprises, owned technology entities and paid contracting of S&T projects, among others. In this way, S&T envoys have formed common interest communities with local farmers, professional households and leading enterprises.

Third, the S&T for entrepreneurship service mechanism in rural areas has been adapted to form a sustainable policy system supporting the entrepreneurship service for S&T personnel, with a working mechanism characterised by "the integration of government-driven and market-driven incentives, the share of both interests and risks, and the combination of encourage and restriction."

Fourth, S&T envoys went to the frontline of production in rural areas and organised the implementation of agricultural industrialisation projects. They set their focus on regional strengths and competitive advantages, and cultivated a group of leading agricultural enterprises.

Importantly, improvement has appeared in the S&T literacy of farmers and therefore their ability to profit from innovation. This has made an active contribution to the development of the overall labour quality in rural areas, especially in their ability to relieve poverty and to become richer with the support of S&T.

2.3. Regional development

With the rapid growth of China's economy, regional economic disparities have significantly increased, becoming one of the most important problems tackled by the Chinese government. Since the start of China's reform and opening up in 1978, regional STI organisations have focused on co-ordinating the distribution of regional scientific resources across regions, based on the characteristics of each region's economic and social development and their demands. China has also increased support for the less regions through S&T.

2.3.1 Tibet

In order to improve economic development in Tibet and the living standards of Tibetans, China officially launched the one-on-one aid programme to Tibet in 1973. S&T policy in Tibet back to 1995, when the former State Science and Technology Commission (SSTC) began to give favourable treatment to Tibet in terms of programmes, funding and projects. Thereafter, support for Tibet has become one of the important tasks in China's S&T system. Focusing on Tibet's economic and social development needs, the policy approach constantly innovates in the forms of aid it provides and in expanding the content of that aid. It supports the S&T development of Tibet in terms of talent, technology, capital and equipment.

In August 1995, the former SSTC officially launched one-on-one aid to Tibet from different local S&T commissions. In January 1996, SSTC conducted feasibility studies and selected 80 projects regarding Tibet, and allocated them to different provincial or municipal science and technology commissions based on the contents of the projects and existing partnerships. By the end of 1998, the number of S&T projects to Tibet reached 133, with total funding of RMB 28.6 million.

MOST launched its policy of supporting Tibet through S&T in 1996, after which it held two national workshops to discuss support measures in the area of S&T and one experience-sharing conference. MOST has facilitated almost 200 agreements on aiding Tibet through S&T signed by organisations and enterprises in Tibet and in other provinces and municipalities, with aid amounting to almost RMB 100 million. During the 10th Five-Year Plan period, national S&T project funding was

RMB 130 million. In June 2007, the National Experience-Sharing Workshop on Aiding Tibet through Science and Technology was held. It summarised the experience and achievements of the policy and clarified the major tasks of the national S&T system in aiding Tibet during the 11th Five-Year Plan period (see Table 2). In the conference, 41 aid agreements were signed between six prefectures and cities in Tibet and relative S&T organisations in other provinces or municipalities, with the total aid funds amounting to RMB 20 million. During the 11th Five-Year Plan period, the MOST unit in Tibet had undertaken 293 national S&T projects, and had provided RMB 219 million in funding. Support was pursued in depth during the 12th Five-Year Plan period. A number of national S&T projects had been allocated to Tibet and Tibetan areas in four provinces. These included the National Key Technology R&D Programme, Agricultural Science and Technology Achievements Transformation, SME Technology Innovation Fund, and Science and Technology Minister Funds. In 2013, there were 67 S&T projects, and the funds amounted to RMB 127 million.

Table 2. Aid investment in Tibet through S&T

Year	ATST Projects	ATST Funds (million RMB)
1996-1998	133	29
2001-2005	---	130
2006-2010	298	219
2011-2012	110	189
2013	67	127

Source: MOST

In recent years, with the wide participation of the entire national S&T system and the common effort of all S&T personnel in Tibet, significant achievements have been made in the following five areas:

The ability of farmers and herdsmen to increase income has been significantly improved. Increasing the adoption of S&T to help farmers and herdsmen has been the top priority. According to preliminary statistics, more than 80% of the implemented projects are related to improving agricultural production and the training of farmers and herdsmen. Special attention was also paid to providing technological training and field guidance to farmers and herdsmen. During the past two years more than 20 000 farmers and herdsman in Tibet received technological training.

Key industries in Tibet are better developed. The aid to Tibet through S&T has closely focused on several industries, such as modern agriculture and animal husbandry; Tibetan medicines and pharmacology; biological, mineral resources and new energy sources; and tourism. The focus was set on overcoming technological bottlenecks in industrial development. Examples include the following: with the support of MOST, the Tibetan Traditional Medical College built the Tibetan Medicine Technology Platform. Building this platform involved cataloguing Tibetan medicines and conducting research on the quality standards of traditional medicines. Many Himalayan plateau bio-products have since been developed, such as the Rhodiola products series, wild peach juice drinks, Tibetan Gecko tonic wine, and Tibetan butter tea bags, which marks the rapid development of the plateau bio-industry in Tibet. In addition, MOST has supported the Bright Project, which promotes hydroelectric energy development in Ngari Prefecture; and the Western New Energy Initiative, which promotes solar energy storage technology, among other initiatives.

Key technological support has been given to the protection of environmental and cultural resources in Tibet. MOST created the Research and Demonstration of the Restoration Technology of Alpine, Arid and Degraded Ecosystems project to help protect Tibet's environment, and has already allocated RMB 6 million to support the project. MOST also supported the Research on Plateau Fire

Safety Technology, with Potala Palace (Lhassa) as a case project. In addition, MOST provided RMB 20 million for the Research on the System to Guarantee the Safe Operation of the Qinghai-Tibet Railway project.

Basic S&T capacity has been significantly improved. The ability of Tibet to engage in its own S&T capacity building was encouraged in various ways, such as building the platform for the exchange of industrial technology information, holding training seminars, piloting the S&T Envoy System, inviting experts to give guidance, establishing training centres, and encouraging personnel exchanges and co-operation between Tibet and other regions.

Box 2. Project achievements of aid to Tibet through S&T

- The "Demonstration of New Varieties of Barley" project implemented by Liaoning Province led to an increase in the average local yield of barley from 80 kg/mu[1] to about 240 kg/mu in the Nagqu Prefecture.
- The "Domestication and Cultivation of Rhizoma Gastrodiae" project in Nyingchi Prefecture, implemented by the Guangdong Province, resulted in the production of farmed rice meeting the standards of wild Rhizoma Gastrodiae.
- The "Research on Introducing, Screening and Cultivation Technologies of New Varieties of Vegetables" project carried out by Tianjin to help Qamdo prefecture changed traditional local planting habits and increased the average revenue per mu by RMB 3 848.5.
- The "Construction of Fruit Technology Demonstration Park in Zanda County" project implemented by Shaanxi Province to help Ngari Prefecture taught farmers and herdsmen to grow watermelons for their own consumption, and increased their annual net income by more than RMB 5 000 per household.
- The "Seed Breeding and industrialisation of Canola" project carried out by Nanjing to aid Maizhokunggar County increased local per capita net income by RMB 350.Many projects laid the foundation for leapfrog developments in S&T for local farmers to overcome poverty and achieve a comparatively comfortable standard of living, such as a grass planting project carried out by Heilongjiang Province, and a project related to the deep processing of high-quality buckwheat products.

2.3.2. Xinjiang

Aid to Xinjiang through S&T was a policy implemented to alleviate the unbalanced development between China's eastern and western regions and to promote economic and social development in remote ethnic minority areas. Dating back to the 1950s, aid to Xinjiang through S&T has played an important role in the overall deployment of policy. In recent years, the S&T community has implemented various projects mandated by the CPC Central Committee and the State Council to support the development of Xinjiang. In particular, since a new initiative of supporting Xinjiang through S&T was launched in 2007, all departments and local authorities have attached great importance to this initiative with resultant plans and actions.

MOST has issued a number of policies in support of Xinjiang's S&T system, including in 2008, a special fund for aid to Xinjiang, with a priority of supporting co-operative S&T projects. MOST also issued 20 polices to support projects to aid Xinjiang carried out by research institutes, universities and enterprises at the central, provincial or municipal levels, as well as encouraging organisations in Xinjiang. MOST continues to increase its support for S&T development in Xinjiang in terms of

[1] 1 mu equals 666.7 square metres.

project allocation, talent cultivation, building S&T bases and encouraging international S&T co-operation. From 2010 to 2012, MOST had allocated more than 300 projects in the national S&T system to aiding Xinjiang, with funds amounting to RMB 10.6 billion (Table 3). According to incomplete statistics, among national S&T programmes in 2013, almost 30 approved projects were to support Xinjiang, with the total funding amounting to almost RMB 400 million. National efforts to aid Xinjiang through S&T have increased over time.

Table 3. Investment in aiding Xinjiang through S&T

Year	AXST Projects	AXST Funds (million RMB)
2001-2005	---	402
2006-2009	1 000	932
2010-2012	700	1 060
2013	300	400

Source: MOST

Various institutions provided support towards Zinjiang's research infrastructure. For instance, the Ministry of Education supported research quality in different academic disciplines and innovation capacity in the universities in Xinjiang. The Chinese Academy of Sciences (CAS) launched an initiative to support Xinjiang and established a co-operative mechanism with local governments. The Chinese Academy of Engineering organised consultations and demonstrations by its academics in fields such as water resource management, energy base construction and deep prospecting.

The co-ordination and collaboration among the eastern, middle and western regions have improved over time. For instance, the S&T departments of ten provinces and municipalities in eastern China have formed a "10+2" conference system on S&T topics with Xinjiang's Science and Technology Department and the Science and Technology Bureau of the Xinjiang Production and Construction Corps. A number of provinces and municipalities – including Shanghai, Guangdong, Jiangsu, Jiangxi, Sichuan and Hunan – have also set up special programmes to aid Xinjiang in their S&T programmes.

Between 2000 and 2010, 938 S&T co-operative projects were carried out in Xinjiang, with total funding of RMB 17 billion. The major achievements of these projects can be summarised as follows:

Innovation in agriculture and animal husbandry has been supported, leading to notable developments. A number of S&T co-operative projects have been carried out on grain, cotton, fruit and animal husbandry supporting the income of local farmers and herdsmen. To give an example, the S&T project on cotton helped boost the quality of cotton produced in Xinjiang.

S&T achievements have supported the development of emerging industries of strategic importance. The region has been successful in the fields of mineral resources exploration and development, wind energy, new materials, and bio-pharmaceuticals, as well as in the coal and petroleum chemical industry. It is home to number of innovative enterprises that are well-known both at home and abroad such as Tebian Electric Apparatus Stock, Xinjiang Goldwind Science & Technology, and Xinjiang Joinworld.

S&T investments in the region to address environmental and health challenges have supported wellbeing. For instance, the Study on the Evolution and Control of Ecological

Environment in Arid Areas of Western China project, listed in the National Key Technologies R&D Programme, made breakthroughs in the theory of desertification control. Its findings were used in the construction of the protection system of north-to-south water diversion in Xinjiang and the recent comprehensive remediation project of the Tarim River. In the area of health, the Research on Chronic Kidney Diseases and Intervention Measures among Urumqi Residents project has considerably reduced chronic kidney disease among local residents.

Basic S&T conditions have improved as a result of various approaches adopted. A number of key laboratories and engineering technology research centres have been established in universities, research institutes and enterprises that are relatively strong in S&T, and there are five national key laboratory bases co-established by MOST and provincial governments. At the same time, many provinces and municipalities have also established S&T co-operative bases in Xinjiang.

The indigenous innovation capability in Xinjiang has improved considerably. From 2006 to 2008, researchers in Xinjiang published 13 380 papers in scientific journals listed in the Science Citation Index, Engineering Index, Technology Conference Record Index, and China Scientific and Technical Papers and Citations Database. Each paper is cited on average 2.22 times. Xinjiang is now "one of the ten regions with the fastest growth rate in average times cited per international paper" (ISTIC, 2009). By the end of 2009, 8 988 major S&T achievements were recorded and 14 500 patents granted in Xinjiang.

The number of S&T personnel in Xinjiang has also grown to more than 400 000, including four academics of the Chinese Academy of Engineering. Xinjiang has also attracted specialists and promoted STI specialists and the building of innovation teams through programmes and activities on talent cultivation, such as the Western Light programme, the National Project on the Training of National High-skilled Specialists, and the Training Programme of Special Ethnic Minority S&T Personnel.

The process of internationalisation has accelerated, and S&T co-operation with Central Asian countries, Russia and other neighbouring countries sought. In 2007, MOST and the government of Xinjiang co-hosted the Exhibition on High Technologies and Products of China in Astana, Kazakhstan, which engaged 120 enterprises from 16 provinces, autonomous regions and municipalities. Making full use of its geographic advantages, Xinjiang's researcher co-operate on S&T with Central Asia and Russia, together with other Chinese provinces. Progress has been made in more than 20 fields, including agriculture, animal husbandry, earthquake and remote sensing, nonferrous metallurgy, geological exploration and environmental protection, among others.

2.3.3. Development of the western region

China's territorial imbalances in terms of social and economic development are significant, with the eastern region being more developed than the western region which comprises 12 provinces, autonomous regions and municipalities, including Shaanxi, Gansu, Ningxia, Qinghai, Xinjiang, Sichuan, Chongqing, Yunnan, Guizhou, Tibet, Guangxi and Inner Mongolia. In recent years China has issued a series of polices to guide and support the western region to participate in and benefit from China's modernisation.

The deployment at the regional level of strategic development policies has been enhanced: since 2000, China has been committed to promoting the region's economic development, aiming at "using the surplus in economic development capacity of the eastern coastal region to increase the social and economic development level of the western region and to consolidate national defence." Since the 11th Five-Year Plan period, China has issued a series of documents and policy approvals, and increased

support for the economic development of the western region through certain policy preferences. Infrastructure investments have also been substantial to improve the regions' linkages with others.

The strategic deployment of S&T in the western region has been strengthened. On the national level, a series of policies have been issued to support industry or talent development in the western region. Under the guidance of the S&T strategy stipulated in the national plan for the macro-regional development, regional development plans have been developed including, for instance, the strategy of rejuvenating Chongqing through science and education initiated by Chongqing, and the establishment of Guanzhong-Tianshui Economic Zone.

In terms of regional S&T policies in the western region, greater importance has been set on improving productivity, overcoming limitations created by the lack of resources and the poor environment. Due to shortcomings in the STI system, the focus of S&T policy is more on the absorption and utilisation of S&T achievements. Among other priorities are improving human capital, enhancing awareness of S&T and promoting the building of the regional STI systems. Finally, appropriate assessment mechanisms need to be in place to guarantee the implementation of S&T policies.

After more than a decade of policy priority given to western regions, in the first three quarters of 2013, per capita disposable income in the country's western urban and rural areas went up by more than 10% and 13%, respectively. Government policy has now entered a crucial phase for building a moderately prosperous society, in which transformation is accelerating and policies of reform and opening up begin to have significant impacts in the western region.

Table 4. S&T Policies in some regional development plans of the western region

Project	Region	S&T policies in regional development plans
Pilot zones of comprehensive reform	Chengdu	1. To transfer S&T resources and factors to agriculture and rural areas and to accelerate STI in agriculture. 2. To establish training facilities in vocational schools of all levels and to provide training for migrant workers. 3. To develop the national high-tech industrial development zones and national economic and technological development zones in Chengdu.
Key economic zones	Guanzhong-Tianshui	1. To use S&T advantages, geographic conditions and industrial foundation, to co-ordinate various S&T resources, to enhance indigenous innovation capabilities, to form regional innovation systems with core competitiveness, to make major breakthroughs in the innovation of core technologies in key fields, to guide innovation factors into enterprises and to form distinctive industrial clusters. 2. To develop innovative regions building on institutional innovation, technological innovation, environmental innovation, and talent development.
Opening-up zones	Yunnan bridgehead	1. To deepen agricultural S&T exchanges and cooperation in the Greater Mekong Sub-region (GMS), to build a number of agricultural S&T demonstration bases and animal epidemic surveillance stations; to strengthen agricultural technology guidance and to make Yunnan a hub for the promotion of agricultural technologies in Southeast Asia. 2. To enhance co-operation among enterprises, universities and research institutes, to promote the establishment of a strategic innovation alliance on industrial technologies, and to improve the indigenous innovation capabilities. 3. To actively foster emerging industries of strategic importance; to promote energy conservation, reduce emissions and develop waste recycling programmes.

Provinces supported by policy documents	Ningxia	1. To promote the role of S&T and to accelerate the implementation of a sustainable development strategy centred on aquatic ecosystem preservation. 2. To promote the development of farming and animal husbandry industries in Ningxia based on S&T progress and agricultural S&T service systems. 3. To support the construction of S&T incubators for SMEs and trading venues for intellectual property rights. To support the construction of S&T demonstration parks in Ningxia and the creation of the Yinchuan economic and technological development zone as a national high-tech industrial development zone. 4. To encourage the transformation of traditional industries using advanced technology and advanced applicable technologies, and to improve the equipment and competitiveness of local businesses.
	Guizhou	1. To develop emerging industries, such as new materials, electronics, information technologies, biotechnologies, new-energy vehicles, etc. 2. To encourage the formation of alliances between enterprises and research institutes and to increase R&D in core and key technologies. 3. To encourage large national research institutes and key universities to establish research branches or centres to support the establishment of national key (engineering) laboratories, engineering (technology) research centres and enterprise technology centres.

Source: Based on Chinese government documents

3. Industrial development

Inclusive innovation and industrial development are linked in the following ways:

Firstly, inclusive innovation can promote the development of an industry or a subsection of an industry by providing affordable products for low-income producers. Inclusive innovation includes both "top-down" and "bottom-up" models. The "top-down" model refers to innovation activities organised or supported by the government. It mainly targets products with strong positive externalities inventors cannot fully appropriate. The "bottom-up" model refers to entrepreneurial innovation activities. Through innovation in product functions, design, manufacturing processes or business models, enterprises can reduce production costs, thereby reducing product prices without reducing its quality. Therefore, such products become affordable to lower-income users.

Secondly, the development of emerging industries calls for inclusive innovation. According to the industrial life cycle theory, emerging industries in the earlier stages of development with relatively immature technologies, market development and industrial systems often need policy support and protection before entering the mature stage. There are two aspects supporting industrial development through inclusive innovation policies. First, an environment of fair competition should be created for emerging industries that allows "everyone" to engage. Second, markets for emerging industries should be created, so that the dual goals of "everyone engaging in innovation" and "everyone sharing innovation" can be achieved. Creating markets for emerging industries and lowering thresholds to enter new markets could let more innovators benefit from the market; let more people share new technologies and products and benefit from technological progress; and achieve inclusive innovation's goal of "everyone sharing innovation".

3.1. Governmental-mandated research: the case of research on antimalarial drugs

In 1964, during the Vietnam War, Vietnam suffered from a malaria epidemic. At the request of the Vietnamese government, in 1967 then-Premier Zhou Enlai personally deployed the "development of antimalarial drugs" initiative (referred to as the 523 Plan). This initiative gathered more than 500 researchers from more than 40 national scientific research institutions and medical colleges. The

"collaborative research group on artemisinin" was led by a unified national organisation. At the initial stage, experts mainly looked for clues from Chinese traditional medicine as basis for antimalarial drugs. These efforts eventually succeeded. It took 15 years (1972-1987) to develop artemisinin derivatives, from a single drug to compound drugs, from laboratory extraction to scale production, and finally to the market. It is an example of development efficiency and speed in drug innovation.

In 1994, Novartis and China signed a 20-year "patent license agreement". After 15 years of collaboration, Novartis invested more than USD 100 million for an R&D evaluation of the Chinese compound. The evaluation concluded that all of the original experimental data gathered by Chinese scientists could be verified and accepted by international institutions. The artemether/lumefantrine product received a Novartis trade name. In 2002 it was recorded on the Model List of Essential Medicines. It was selected by a number of African countries as the first-line malaria treatment drug and recommended by the World Health Organization, Médécins Sans Frontières and the Global Fund. The product has been registered in 79 countries and regions; and is sold in 28 countries and regions.

The advantages of "top-down" inclusive innovation policies are that they focus on providing urgently needed products for vulnerable groups. R&D of artemisinin benefitted from the concentrating power of the government to meet the demand of vulnerable groups in a short time. In order to strengthen joint research of artemisinin, a national group of different sectors in the study of malaria prevention and control was set up to develop three proposed plans at the initial implementation stage of the task. Under the guidance of planning, R&D of artemisinin took place under a team that co-ordinated drug discovery, process development and other supporting steps to ensure the smooth development of the work.

3.2. Creating a fair market environment for emerging industries: the case of China's photovoltaic industry

Solar energy has become the focus as a renewable energy source. China's photovoltaic (PV) industry enjoys rapid development building on its low cost advantage. In 2007, China's production of photovoltaic cells for the first time surpassed that of Germany and Japan, ranking first in the world. However, due to a lack of effective policy support, China's PV industry chain suffers from a "two out" dilemma, namely that upstream supply of raw materials comes from foreign countries, and that the demand for downstream products is largest abroad. To speed up the development of the domestic market, promote technological progress and the large-scale development of the national PV industry, and to develop strategic emerging industries, in 2009 the central government launched the Golden Sun project, which provides financial subsidies to support photovoltaic power generation demonstration projects.

The Golden Sun project is supported by project-based subsidies, including financial assistance aimed at increasing access to electricity from photovoltaic, wind, water and solar energy. From 2009 to 2012, the Golden Sun project was divided into four phases, carrying out a total of more than 900 demonstration projects, receiving more than RMB 20 billion in subsidies from the central government. It developed a design, planning and businesses operation group of photovoltaic power plants and formed in this way a complete industrial chain of photovoltaic power plants and operating models. It played an important role in creating a photovoltaic industry market, reducing photovoltaic power costs and improving the development of the photovoltaic industrial chain.

In addition, the project promotes the sharing of technical achievements. It promotes the role of solar energy in saving energy and improving the electricity utility environment in remote areas. In 2011, for example, the Golden Sun project launched 15 independent photovoltaic power plants in

remote areas without electricity, located in 7 central and western provinces, such as Gansu, Qinghai, Tibet, Xinjiang, Inner Mongolia, Hunan and Yunnan.

Box 3. Golden Sun project in Qinghai

The Qinghai provincial government organised and implemented the National Golden Sun Demonstration project in order to improve the living conditions of the population without electricity and to create access to electricity. From 2009 to 2012, Qinghai Province launched a total of 61 projects, of which 24 were national projects, with total capacity of 89 MW. Until October 2013, the project had received RMB 1.4 billion in central government subsidies for PV power plants for household power, communication base stations and photovoltaic water pumping for irrigation and other projects. The outcome was improved access to electricity and drinking water to local residents and animals.

3.3. Promoting innovation and entrepreneurship in SMEs

The promotion of sustainable development of SMEs is critical to foster inclusive innovation. At present, the number of SMEs and non-public enterprises exceeds 40 million, accounting for 99.8% of total enterprises in China, among which more than 10 million SMEs are in the the business sector and more than 30 million are self-employed households. Many SMEs in China are often in a "vulnerable" position as they lack competitiveness. As is the case of many countries, by the end of 2013, the central government has invested RMB 15 billion in special funds for SMEs and micro enterprises. Local governments also set up supportive special funds of several billion Renminbi to promote innovation and the development of all types of SMEs.

The Chinese government adopted several measures to promote the development of innovation and entrepreneurship in SMEs, such as reducing SMEs' tax burden through tax preference policy; simplifying administrative approval procedures to increase the vitality of the market for SMEs; and innovating institutional mechanisms in terms of financial, social services and other aspects to encourage financing, technology, personnel and other diversified services for SMEs. Learning from internationally accepted principles, the Chinese government provided direct support for SMEs by setting up the Spark Plan, the Torch Programme and the Technology Innovation Fund for S&T SMEs. It also set up guiding funds for the Agricultural Science and Technology Achievements Transformation among other special funds for SMEs.

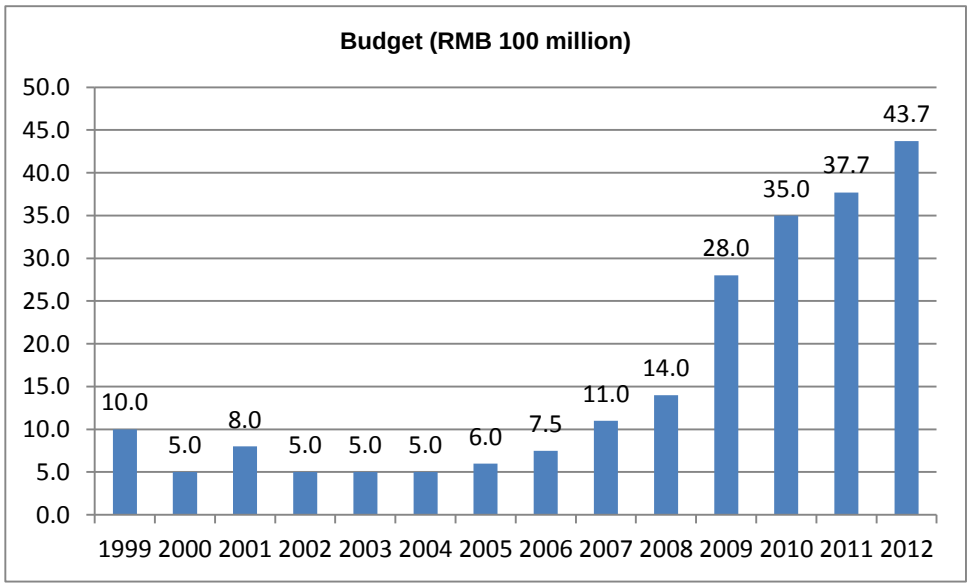
3.3.1. Innovation Fund

In 1999, the government established the SME Technology Innovation Fund (hereinafter Innovation Fund), which was designed to enhance the capability of indigenous S&T innovation by SMEs, and to guide local authorities, enterprises, venture capital and financial institutions to increase investment in SMEs' technology innovation, so as to continuously improve this environment. After that, supporting policies were gradually introduced.

The Innovation Fund is operated according to the objective rules of the market economy to support innovation and encourage entrepreneurship. The Innovation Fund supports three kind of key projects. One type is S&T SMEs in the early days, without qualified commercial capital and in most need of government support. A second is qualified service agencies who provide basic, non-profit and open professional and technical services for SMEs to carry out technological innovation and promote entrepreneurship. The third type is start-up S&T SMEs supported by venture capital institutions using market mechanisms such as equity, grants and investment protection.

Since its establishment in 1999, the budget of the Innovation Fund has grown steadily. Especially after the international financial crisis in 2008, the State Council issued a series of policies and measures to support the development of SMEs in innovation and entrepreneurship. The overall budget of the Innovation Fund has grown rapidly, from RMB 1 billion in 1999 to RMB 4.37 billion in 2012 (see Figure 1).

Figure 1. Innovation Fund budget (1990-2012)



At the end of 2012, the Innovation Fund invested a total of RMB 22.1 billion in 39 836 projects supporting more than 30 000 S&T SMEs, mobilising more than RMB 150 billion. It has supported a variety of technical innovation services (platforms) and provided more than 30 million technical innovation services to more than 1.5 million S&T SMEs and training to 1.82 million employees. The Fund also supported over 1 100 venture capital institutions and projects, directly contributing more than RMB 10 billion. It guided local governments to set up a variety of guiding venture capital funds, indirectly stimulating over RMB 150 billion in social capital. All of these promoted the technological innovation of China's S&T SMEs and increased their economic benefits (see Table 5). In doing so, the Innovation Fund nurtures and develops such strategic emerging industries as electronic information, biological medicine and new materials, and creates millions of jobs.

Table 5. Comparison of economic benefits of support from the Innovation Fund

	Revenue (billion RMB)		Foreign exchange earnings (billion RMB)		Annual net profit (billion RMB)		Annual tax payments (billion RMB)	
	Before approval	After approval	Before approval	After approval	Before approval	After approval	Before approval	After approval
2008	35.9	80.3	0.376	1.160	3.628	6.621	2.633	4.986
2009	81.3	133.1	0.982	1.278	8.587	13.435	5.774	9.564
2010	131.4	227.6	1.472	2.670	12.654	24.507	8.113	14.729
2011	193.5	314.0	2.076	3.913	16.434	32.096	13.183	19.208
2012	360.3	612.7	4.127	7.162	34.492	61.839	22.753	37.916

Box 4. Success stories: S&T SME venture capital to guide funds to participate in share equity

This share equity project started in 2008 and is aimed at offering funding to first-time innovators. Together with a professional joint venture team, this project raised social capital and initiated six venture capital organisations. In 2012, the first phase of the project was completed, in which all of the financial resources in the guiding fund were invested. At of the end of 2011, the six fund-raising institutions had collected a total of RMB 1.35 billion in venture capital and incentivised other investment institutions to jointly invest nearly RMB 3 billion.

The project helped many SMEs to achieve technological breakthroughs and enhance their competitiveness, such as the following:

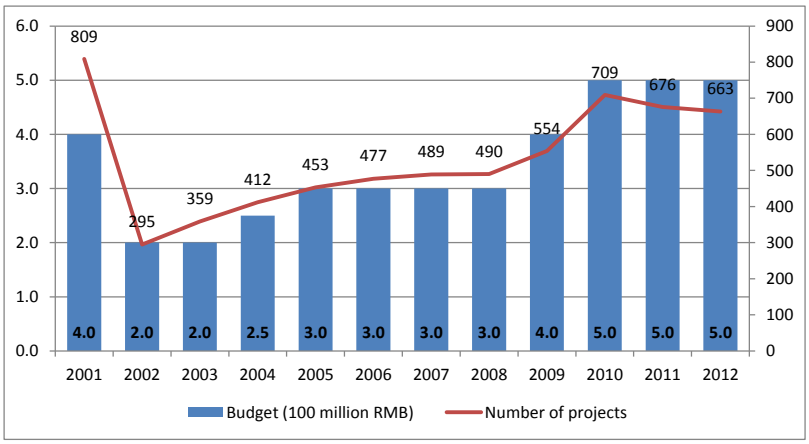
- RE-energy Electric (Suzhou), a leading domestic provider of pitch control mechanisms for wind turbine generators; along with Sha Daile New Materials Technology, the firm developed the diamond wire, and challenged the monopoly held by Japanese and US companies in this market.
- Hefei Huasheng Valve, a producer of pump valves for petrochemical and chemical use, the improved its research and development in consequence. The company currently has 13 patents, including 10 invention patents and 10 patents key to the formulation of national standards.

3.3.2. Agriculture Transformation Fund

In 2001, the Chinese government established the Agricultural Transformation Fund. It is the only fund supported by the central government for the early development and production, pilot and maturation of S&T achievements in agriculture, water conservancy, forestry and other fields. The project mainly supports agricultural science and technology enterprises, including by encouraging collaborations with research. By the end of 2013, the central government had invested a total of RMB 4.15 billion in the Agricultural Transformation Fund, supporting 6 386 projects (see Figure 2).

Through the implementation of these projects, agribusiness has played a major role in technology innovation, the industrial structure of agriculture has improved, and a series of new technology achievements have been implemented. In addition, agricultural efficiency has been promoted, rural incomes have increased, and new types of farmers and agricultural researchers have been trained. During the 11th Five-Year plan, the transformation funds supported 86 400 training courses serving 16.2 million trainees. A total of 980 000 new jobs were created as a result.

Figure 2. Agricultural Transformation Fund: budget and numbers of projects, 2001-2012



Box 5. Success stories: pilot and demonstration of new varieties of high-yield corn

A project to pilot and demonstrate new varieties of high-yield corn was hosted by Beijing Golden Agriculture Seed Industry with the participation of Beijing Denong Seed Industry and Lianchuang Seed Industry. The project was implemented from April 2011 to April 2013, and resulted in the pilot and demonstration of a series of new high-yield varieties of maize. The total funding was RMB 14.5 million, of which RMB 3 million was allocated by the central government and RMB 11.5 million was raised by the Beijing Golden Agriculture Seed Industry.

Since the implementation of the project, the businesses involved have conducted significant research in supporting technology, field testing and technology promotion. Several new technologies have been integrated into seed production, quality control and cultivation techniques, and in the demonstration and promotion system. High-yield and high-efficiency cultivation systems such as early sowing, rational close planting, double fertilisation, jointing and flowering irrigation, pest prevention and management techniques were also tested and implemented. Denon No. 1 Seed Industry, for example, developed scientific procedures of corn seed production, and parent seed production technology rules such as coated parent seeds; a system of mulching techniques; a system of soil testing and fertilisation; and the use of drying towers to dry seeds after harvest. During project implementation, two processing production lines for corn seed selection were established, producing a total of 32.72 million kg of seed, establishing 880 experimental demonstration bases across an area of 15.26 million mu for promotion, with total sales revenue of RMB 392.47 million, a net profit of RMB 84.08 million, and creating 221 new jobs and training 264 000 people.

3.3.3. Spark Plan

The Spark Plan is the first plan approved by the Chinese government to promote economic development in rural areas relying on science and technology. It is an important component of China's national economic and S&T development plan. The Spark Plan aims to foster the application of advanced science and technology achievements in rural areas, to guide hundreds of millions of farmers to develop the economy through S&T. Its main goals are: improving labour productivity and economic efficiency by using S&T; guiding farmers to change their traditional production methods and lifestyles; developing a number of pillar industries in Spark technology-intensive areas and regions through S&T advancement; pushing forward township enterprises in key industries to promote S&T progress; training personnel on rural applicable technology and management; and improving the overall quality of life of rural workers.

In 2012, 1 473 projects were launched by the National Spark Programme, with a total of RMB 200 million in funding. There are 5 062 various types of Spark training bases and 3 180 Spark schools. Spark technology training invested RMB 4.279 billion at all levels, training 11.83 million people, compiling 21 800 kinds of teaching materials, printing 11.43 million publications, and writing 16 000 distance-learning texts. In 2013, the National Spark Programme at all levels supported 3 454 brand-name projects. According to MOST, the Spark industrial belt covered an area of 624 900 square kilometres, 114 000 companies, and a total labour force of 12.3 million.

Box 6. Achievements of the Spark Plan

- **Explored a new model of rural technology services, so as to form a team participating in technology and services in rural areas.** Under the programme, Zhejiang Province implemented the S&T Envoy System (see section 2.2).
- **Fostered regional pillar industries to promote the economic development of counties.** Shidu town, a Spark intensive area in Beijing, conducted a large-scale environment renovation project on the outskirts of the town, including developing a basic tourism infrastructure, with a sightseeing area, picking garden and leisure fishing park.
- **Bridged the digital divide, and promoted the process of information dissemination in rural areas**. The Spark Plan developed and built a rural S&T information service platform and the Spark 110 S&T information service contributions platform, which provides relevant information for rural areas to most regions of the country.
- **Promoted economic development in poor areas to help farmers out of poverty.** In 2007, the Spark Plan established remote training centres at the county level in six counties, which helped to alleviate poverty, directly trained more than 10 000 people, and identified 14 model villages in designated poor counties.
- **Awakened consciousness of S&T in the majority of farmers and improved their ability to use technology.** The Spark Plan carried out scientific and technological training appropriate to existing local conditions, training a large number of rural practical specialists, rural science and technology leaders and rural technology "secondary" leaders to inspire farmers' enthusiasm for S&T, and improve the ability of farmers to use technology.

4. Promoting grassroots innovation

Grassroots innovation is an important practice to promote inclusive innovation in China. The Chinese Government has always attached great importance to promoting grassroots groups' scientific literacy and education to enhance grassroots innovation. Various organisations actively participate in promoting grassroots innovation providing incubation support, financial support and technological consultation. With the support, blue-collar workers, unemployed workers, farmers, students and teenagers alike carried out a series of inventions and innovation activities. These efforts not only created economic value, but also brought social benefits.

In order to enhance the country's inclusive innovation capability, it is necessary to promote people's scientific literacy. In recent years, the Chinese government has intensified its work in strengthening the popularisation of S&T in various aspects. Its efforts mainly focus on promoting equitable access to education and promoting scientific knowledge among the public (especially disadvantaged populations from underdeveloped regions), increasing investment in compulsory education and vigorously developing basic education in underdeveloped regions.

4.1. Science literacy and education

In recent years, China has invested in developing its legal system and policy planning regarding the development of popular science activities. The Law of the People's Republic of China on Popularisation of Science and Technology (2002), the Outline of the National Programme for Medium- and Long-Term Scientific and Technological Development (2006-2020) and the National Action Plan for Scientific Literacy (2006-2010-2020) aim at promoting scientific literacy as an important effort to support the country's development. As well as targeting science popularisation in underdeveloped regions, China has also created designated policies including guidelines on improving

the science and technology work, on popularising science in towns and cities and promoting science and technology work in ethnic minority regions.

The central government and local governments carried out various science popularisation activities, many of which have been very successful. For example, in 2006 the central government started the "science popularisation benefitting villages and agriculture project" through "model demonstrations". The project recognises efforts of outstanding, demonstrative and far-reaching professional agricultural associations, science demonstration bases, pioneers in rural science popularisation and science popularisation teams for ethnic minorities. The China Association for Science and Technology, Ministry of Education, and MOST has also organised an annual event, National Youth Science and Technology Innovation Contest. Moreover, MOST jointly with five other departments, including the CPC Department of Organisation and the China Association for Science and Technology, launched the Rural Youth Science and Technology Innovation Laboratory project.

In recent years similar social and market-oriented activities have also developed. In particular, with the development of information technology, a new generation of social media such as micro-blogs (*weibo*) and wechats (*weixin*) provide opportunities for social science popularisation activities. Science-oriented non-governmental organisations such as Scientific Squirrels (*kexue songshuhui*) and Guokr (*guokewang*) are becoming important in China's science popularisation activities.

Box 7. National action plan for scientific literacy

The National Action Plan for Scientific Literacy promotes national scientific literacy by developing education, popularising and spreading knowledge of science and technology. A first objective for 2020 is to have developed an infrastructure that allows spreading S&T more widely. The long-term goal is to provide all Chinese adult citizens with basic scientific literacy by 2050. The Action Plan's leader's group is set up by the State Council and sets up action plans to improve scientific literacy among the young, farmers, urban workers as well as leaders and public servants.

In recent years China's efforts in improving science popularisation have developed rapidly. In 2012, total funding was of RMB 12.288 billion, of which the government granted RMB 8.504 billion (see Table 6). The percentage citizens with basic scientific literacy doubled and reached 3.27% in 2012 from 1.60% in 2005.

Table 6. Changes in funding for the popularisation of science, 2008-2012 (in billion RMB)

Methods	2008	2009	2010	2011	2012
Government funding	4.7	5.894	6.808	7.259	8.504
Donations	0.083	0.098	0.137	0.084	0.082
Self-funding	1.23	1.928	2.38	2.565	3.075
Other income	0.482	0.791	0.626	0.622	0.629

Source: Statistics National Science and Technology Resource, MOST

The 12th Five-Year Plan of China's National Educational Development, issued by the Ministry of Education, included the objective of popularised high-school education, a critical baseline condition for improving the popularisation of science. As a way to promote the development of occupational education and meet the needs of society, the Ministry of Education drafted The State Council's Decision on Accelerating the Development of Modern Occupational Education and the Construction

Plan of Modern Occupational Education System (2013-2020), and developed a new system of modern occupational education. This included the provision of education services to children in poor areas of the country.

4.2. Services for grassroots innovators and entrepreneurs

Scientific and technological services play an important role in supporting grassroots innovation. These services' platforms and networks allow finding suitable partners for grassroots innovators and projects, help incubate projects and provide start-up funding. Such services include the provision of technical advice and guidance for grassroots innovators and projects, as well as intellectual property rights protections and assistance in product development. In recent years, a group of scientific and technological intermediaries dedicated to providing the conditions and guidance for grassroots innovation has emerged in China. For example, Garage Cafe is a start-up and investment-themed coffee shop where entrepreneurs can for the price of a cup of coffee enjoy the free open office environment. Operating since 2011, with 800 square meters that can accommodate 150 people entrepreneurs have conference rooms and advanced display facilities at their disposal. Moreover, Garage Cafe hosts technical consulting and investment activities, such as mutual assistance and exchanges, technological salons, and equity crowd-funding services. In co-operation with the Zhongguancun Branch of the Bank of Beijing, micro-credit loans for entrepreneurial projects are provided. Projects from the Garage Cafe also enjoy preferential financial services from the Bank of Beijing, such as bank deposits and loans, company registration, and corporate and personal financial advice.

Another example is the "nursery garden" created by students of the Nanjing University of Posts and Telecommunications. The nursery garden is a start-up and incubation base co-established by the university and Nanjing Gulou District Government. Its clients are primarily the university's students and recent graduates. The nursery garden is located on the university campus and offers complete basic office facilities of 660 square meters that can accommodate 60 teams of up to 140 students. At the same time, the nursery garden provides entrepreneurs with information resources and training on topics such as finance, taxation, business registration and other relevant issues for entrepreneurs. An online chat facilitate allows early entrepreneurs to communicate with more mature enterprises about ideas on business and technical matters.

Moreover, when setting up their own businesses, grassroots entrepreneurs often encounter difficulties in business development, talent recruitment and legal affairs. Especially for young entrepreneurs with limited experience and resources, professional guidance is needed. The Youth Entrepreneurship Service Association, based in Taizhou city, in Zhejiang province, is a social organisation committed to building an "innovation workshop" for young people. At present, the association has 302 members, including experts and tutors in the fields of law, banking, taxation, business, and human resources. Many well-known lawyers, university professors and high-end talents are members. The association helps young people set up their own businesses by releasing the latest information about policies and the market, as well as channelling information from internal resources. The association is not only a pioneering "starter", but an "absorber". So far, 40 to 50 young people have set up their businesses with the association's help. The association has invested in expanding its database of experts, and has set up its own website.

New services have emerged to provide funding for grassroots innovators and grassroots innovation enterprises. Start-up capital is the most difficult part in transforming innovative products into commodities that can be produced at scale. Demohour.com is a crowd-funding website that was established in 2011 where innovators with creative ideas, novel products and independent creative designs can launch their projects to lobby for financial support. This crowd-funding model differs

from ordinary commercial finance in that those proposing projects enjoy full independence from supporters' control. If a project is fully funded, this crowd-funding practice is more like pre-purchasing in that supporters of the project are actually buyers, rather than investors. If funding is insufficient to implement the project, then sponsors will get their money refunded.

Another interesting funding example is the new three-party (banks, government and enterprises) co-operation model invented in Wuzhen, a part of the city of Tongxiang in Zhejiang province. In this model, the government offers guarantees to business associations and credit units from them to provide tailored "micro and small top-up loans". To apply for RMB 1 million from the association takes only one day and the fee is of RMB 600. By contrast, it would cost RMB 200 000 to apply for this same amount through folk lending or pawn shops.

Some organisations also contribute greatly in studying and spreading grassroots innovation. The Innovation and Entrepreneurship Research Centre of Tianjin University established a database of grassroots innovations: it contains more than 2 000 folk innovation projects and more than 3 000 pieces of data. At the same time, the centre also builds platforms for folk innovation projects. The centre also promotes rural innovation projects to investment companies. The centre continues both its search for folk innovation projects and its efforts in structuring, refining, packaging and spreading them, with the objective of helping more grassroots innovations enter the market.

4.3. Grassroots innovation

In order to solve technical difficulties encountered in production, or to lower the cost of some technologies or products, some individuals belonging to grassroots groups (including Chinese blue-collar workers, unemployed workers and farmers) have engaged created new products and services. These inventions have not only created economic value, but also brought social benefits.

During the 2008 National People's Congress and People's Political Consultative Conference Wan Gang, Minister at MOST, pointed out that skilled workers contribute innovations to industry, and that some of their innovations are integrated into the production processes of enterprises. In contrast, blue-collar workers are normally poorly educated (high-school level or lower) and earn very low salaries. However, they work at the front line of production, so they are often the first to spot problems and difficulties. As their technical skills and work experience accumulates, they become better able to invent and contribute to their industries' innovation.

In recent years, cases of indigenous innovation by **ordinary workers** mushroomed in many local enterprises. For example, Zhang Tao, leading engineer of fleet unloading and technical group leader of the Second Harbour Company of Rizhao Port, is known as the "grassroots innovation master". In spite of his young age, Zhang Tao invented the Unloader Wireless Monitoring System. Whenever a mechanical failure occurs, the system will accurately spot the fault. The invention, which is nicknamed the "remote detector" improved his team's capability and efficiency in dealing with system failures, and enabled remote management and procedural repairs of operational equipment. Several companies are interested in applying the now patented technology.

Starting in 2004, several enterprises in Jiangsu province have established model innovation studios. These studios' main task is to find innovative solutions to problems encountered in production. There are so far 500 such studios in Jiangsu province that have collectively obtained 1 300 national patents, introduced more than 1 500 national scientific and technological innovation achievements, and created economic value of more than RMB 3 billion.

In addition, Shanghai Baosteel Group improved opportunities for its employees to participate in innovation activities. Efforts included holding innovation forums and salons, providing training, rewarding achievements and launching a platform for its employees to share their knowledge and experience. A volunteer team composed of 358 skilled operational staff provided advice. Between 2008 and 2011, staff of Baosteel Group applied for a total number of 4 178 patents, out of which 2 841 patents were authorised. In 2010, 70% of its authorised patents were from front-line "skilled craftsmen".

Unemployed workers are disadvantaged in terms of their social status and often have fewer opportunities to improve their skills. This is not to say, however, that they cannot be innovative and find solutions to challenges, some of which can become viable innovative products.

For example, Zhang Xiaohong, an unemployed worker who used to work for Jiangxi steel wire factory founded her own workshop, Yu Zhou Xiu Fang. Taking inspiration from original Chinese traditional folk embroidery, she created the very successful Xia Bu embroidery brand. She successfully applied for 29 national IP titles and received many national and provincial awards. At the same time, she also trained more than 200 female laid-off workers and rural young women, helping them find jobs. Another example is Zhang Tanwei, a laid-off worker from Zhuzhou in Hunan province. He received a patent for inventing a pipe-connecting device and set up his own professional technology company to commercialise this invention.

In order to encourage and help unemployed people to innovate and set up businesses, many local governments have developed skills training programmes and introduced relevant policies in support. For example, Nanjing has a special loan guarantee centre that provides small loans of no more than RMB 50 000 to local unemployed workers. If unemployed workers set up their own entrepreneurial team, joint-stock enterprise or partnership, then a maximum loan of RMB 300 000 can be provided for a period of one year. Beijing, Shenzhen, and Jiangxi also have similar support schemes for unemployed people.

The majority of China's 657 million **farmers** (2011) have limited education and low incomes and consequently are at a disadvantage when it comes to participating in innovation. Yet farmers have accumulated first-hand knowledge of a large number of technologies that are relevant to agricultural production. Over the years, a large number of innovations by farmers have emerged to show that such knowledge is valuable (see Table 7). Some are small and relate to technical problem in production while others address major problems. For example, the square straw sand-fixing method was invented by a couple of young workers in Shapotou district, Ningxia province (see Table 7). While scientific research efforts had not been successful, the grassroots approach was most effective. This technology won the Special Class National Prize for Science and Technology as a major technological breakthrough in the field of sand treatment. Another example is Shen Kequan, a Hunan province-based farmer who jointly with his sun developed new varieties of rapeseed oil, without experimental facilities and research funding.

University and high school students are another target of central and local government support scheme for innovation and entrepreneurship. There are today many cases of student entrepreneurs in China. In May 2012, Ma Ping, a university student in Changning County, Sichuan Province, left university and returned home to develop the large family farm. He was committed to using his knowledge and technology to change the backwardness of the countryside. So far, Ma Ping has invested RMB 200 000 and introduced 5 000 rare varieties such as red maple, cherry, North American crab apple, ginkgo, sweet scented and osmanthus. He also launched artificial breeding research on Chinese dove trees and several of these rare varieties.

Table 7. Examples of farmers' innovative products or technology

Product /Technology	Inventor(s)	Characteristics
Super rapeseed	Farmers in Hunan Linli county	New varieties of quality hybrid rapeseeds (“Gui Ye A”, “Friendship No. 3” and “Shen You Za”)
Winter (greenhouse) vegetable production technology	Farmers in Liaoning Province	Cucumber greenhouses that did not need heating (developed in the early 1980s and popularised subsequently)
Bicycle ventilator	Farmers in Anyang County, Henan Province	Combination of used bike, pressing machine motor, and ball to form a simple ventilator, used to provide oxygen at controlled intervals
Enhanced waterproofing agent	Farmer in Shanxi Province	Agent allows blocking a 660 m^3/s flow in six seconds, creating a major breakthrough for underground waterproof projects
Sewage treatment agent	Farmers in Yishui County	Industrial wastewater treatment agent that helps meet state emission targets, obtaining national patent in 2005
Sand grass grid technology	Farmers in NingXia	Straw-on-the-sand method solved the problem of mobile dunes that threatened not only the natural habitat but also affecting the railway system
Non-tower water supply system	Daiyue Yamaguchi in Sichuan Province	Automatic water-fetching machine suitable for rural areas developed in the 1980s, the technology has been supported by the Science and Technology Bureau of Sichuan Province

The China Association for Science and Technology, Ministry of Education, and MOST have been jointly hosting the National Youth Science and Technology Innovation Contest since 1979. From primary school to the national championship, nearly 15 million teenagers take part in activities every year. Around 500 young technology enthusiasts are selected each year to participate in the final competition. The contest has become a platform to show the latest science and technology achievements of Chinese teenagers. Examples of technologies demonstrated in these championships have included printable electronic security tape, a voice-controlled multifunctional robot and a rechargeable battery made of biological polymer film. What is more, every year outstanding Chinese scientific research projects by students are selected to participate in international events such as the International Science and Engineering Fair and the European Union Young Scientist Contest.

5. Challenges for the future of inclusive innovation in China

China has improved its performance regarding inclusive innovation practices with regards to social development, agricultural and rural development, regional development, and industrial development, as well as support for SMEs and grassroots innovators. However, many problems remain, such as the large low-income population, unbalanced regional economic development and inequality in the provision of basic public services.

Several policy approaches can help address these challenges: First, the Chinese government should attach greater importance to the inclusiveness of innovation at the policy level. In terms of policy objectives, the government should encourage and support inclusive innovation and have improving low-income groups’ social and economic welfare as one of the goals of its innovation policy. In terms of policy guidance, the government, other public sector organisations and social organisations should provide more resources and support to grassroots innovators, for example by providing funding for R&D, research facilities, technical consulting and commercialisation assistance. In addition, the government should create a competitive market environment for all enterprises and guide enterprises to participate in inclusive innovation by providing the right regulatory framework. Furthermore, the government should encourage more venture capitalists to fund the industries that meet the demand of low-income groups in the fields of agriculture, health and education, among other core areas.

Second, it is important to support grassroots groups and enterprises in realising the value of inclusive innovation. As the most active actors in innovation, enterprises have the opportunity to satisfy demand from the large bottom-of-the-pyramid market in China. In this context, it could be profitable for enterprises to focus on the development of inclusive innovation products, such as low-cost mobile telephones, electronic chips and medical instruments. Grassroots innovators can arguably contribute more as they are committed to improving economic welfare and as they have a wealth of technical skills and experience as they work on the front line of production. Their efforts can complement innovation efforts by traditional laboratory research and development efforts.

Third, identifying the differences between regions and groups is critical in implementing inclusive innovation. While China is the largest developing country in the world, with a large number of low-income people and huge regional differences, the demand for inclusive innovation is not the same across regions, since China's rural and urban areas differ greatly in infrastructure, labour quality and available capital resources. Rural areas need to strengthen transportation, communications, Internet and other infrastructure, and to benefit from low-end innovation products. There is much benefit from promoting new, low-cost, high-quality products and business models and outputs to rural areas in China and abroad. The different habits and specific needs of ethnic minorities must be considered in conducting inclusive innovation. Data on the size of the low-income population as well as their geographical distribution and living conditions are therefore important for inclusive innovation policies. Also important is to determine the problems and difficulties encountered by low-income groups when they participate in inclusive innovation so as to provide a basis for scientific policymaking.

Fourth, the government should improve the policy system to reflect the demands of low-income groups of China and focus on project collection, technology consulting, financial support, project incubation and protection of grassroots innovators' intellectual property rights, and related policy approaches. Since the 1980s, the Chinese government has used S&T to help rural areas out of poverty and encourage grassroots to participate in various innovation activities. These are a useful starting point. However, compared with the Indian government, which established a whole policy chain to find good ideas, help project development and promote commercialisation, China's policy and practices on inclusive innovation are incomplete. First, many of the existing policies emphasise the promotion and popularisation of S&T itself, but neglect to encourage low-income groups to participate in innovation activities. Moreover, a full support chain that would allow connecting project identification, incubation and commercialisation has not been developed yet. In addition, most existing policies were issued in the 1980s or before 2000. With changes in living conditions of low-income groups in China, these policies need to be adjusted accordingly.

Fifth, some enterprises pursue low costs and low prices under the banner of "inclusive innovation" at the expense of product quality. This is contrary to the essence of inclusive innovations which seek affordability while maintaining products' quality. Industry regulations and standards should be introduced as soon as possible and the quality of products should be strictly regulated to prohibit this type of bad inclusive innovation behaviour. Besides, there must be an information system to disclose the misconduct of enterprises and protect the interests of low-income consumers. There is also need for funding support as it is sometimes difficult to obtain benefits from some innovative products for minority groups such as drugs for rare diseases, etc. Finally, some grassroots innovators may lack awareness of intellectual property protection which may lead to a lot of new ideas or inventions being stolen by others to the detriment of the interests of grassroots innovators. The protection of intellectual property rights at the grassroots level should be strengthened, including providing exceptions for patent application and maintenance fees.

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