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ANSO SDG Report

# POVERTY ALLEVIATION SUPPORTED BY SCIENCE AND TECHNOLOGY

# POVERTY ALLEVIATION SUPPORTED BY SCIENCE AND TECHNOLOGY

# VOLUME 1:
# The Practice and Experience of the Chinese Academy of Sciences


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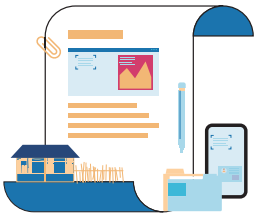




# Chapter 04

# Abstract

Poverty is the chronic pain of society, and poverty alleviation is the greatest challenge for humanity. It is not surprising that "No Poverty" ranks at the top of the 17 goals of the United Nations (UN) 2030 Agenda for Sustainable Development Goals (SDGs). As the world's largest developing country, China has always considered people's livelihood and shared prosperity as its fundamental national development policy. In the past 40 years, China has raised 770 million people out of extreme poverty, which has reduced the global poverty population by more than 70% according to the World Bank's poverty standards.

To further achieve the goal of national Poverty Alleviation, China has launched a series of national initiatives on Targeted Poverty Alleviation (TPA) since 2013, aiming to adopt precise poverty alleviation measures according to different situations. These initiatives focus on different households and regions at local and community levels. In 2016, a nationwide assessment by a third-party was proposed. China, in practice, has continuously promoted theoretical breakthroughs, institutional reforms, scientific and technological innovations in poverty

alleviation, creating a new way to poverty alleviation in Chinese style. From 2013 to 2020, about 98.99 million rural people have been lifted out of poverty according to the new national standard, thus making China the first developing country in the world to achieve the UN Millennium Development Goals, 10 years ahead of achieving the first goal of UN 2030 Agenda. This important milestone proves the effectiveness of the TPA policies and the value of related concrete actions. It also provides an excellent model for other developing countries on achieving the goal of "No Poverty". Since 2020, China has entered a new transition period from the elimination of extreme poverty to achieving relative poverty and rural revitalization. From 2021 to 2025, it is an important task to consolidate the past achievements in poverty alleviation, stimulate endogenous development momentum in rural areas, and gradually narrow the gap between the urban and rural areas.

The Chinese Academy of Sciences (CAS) has always taken the lead of poverty alleviation through scientific and technological (S&T) support in past decades. It has undertaken outstanding work in developing poverty alleviation models and assessing their impacts. CAS has developed, for example, the "Fuping Model" for land consolidation in Hebei Province and the "Kenfu Model" for ecological migration in Guangxi Province. These models were based on local natural-economic conditions and the cooperation with relevant stakeholders. They were initiated by S&T experts and implemented by local governments with the participation of the local people and enterprises in supporting the economic development and eco-environment conservation in rural areas.

The third-party assessment has been proved to be one of the most important measures to evaluate the effectiveness of TPA in practice. It was not only the earliest, but also the most prominent national assessment in the history of global poverty reduction. It has played an essential role as a "quality checker", "baton" and "propeller" in facilitating and promoting poverty alleviation. The research commission of CAS took the lead in the national evaluation of the effectiveness of TPA by organizing a third-party assessment, and also developed an indicator system and the key technologies required. The China Urban-Rural Development Think Tank Alliance (CURDA) initiated by the Institute of Geographic Sciences and Natural Resources Research (IGSNRR) of Chinese Academy of Sciences in 2015, the International Geographical Union (IGU) Committee on Agricultural Geography and Land Engineering (AGLE) in 2016, and the Alliance of Poverty Reduction and Development (APRD) of ANSO in 2020, have provided strong support for timely establishment of the expert teams of third-party assessment, and enhanced multisectoral cooperation and multidisciplinary research.

Chapter I of this report will review the history and achievements of poverty alleviation in China in the past 70 years by summarizing national policies and programs at different stages of socio-economic development. As the key strategy leading to the success of China's poverty eradication from 2013 to 2020, the TPA concept and its implementation measures will be introduced in Chapter II. Chapter III will present the CAS practices and experiences in poverty alleviation. The "Fuping Model" and "Kenfu Model" are highlighted as successful cases in natural-based poverty alleviation in different areas. After that, the experiences of the third-party assessment led by CAS for the precise evaluation of TPA are introduced in details. The last chapter summarizes the recommendations to other developing countries on poverty alleviation.

# Background and History of Poverty Alleviation in China Over the Past 70 Years

# Chapter 1

# 1.1 Background and Characteristics of Rural Poverty in China

Poverty is the greatest common challenge for humankind. Eradicating poverty and achieving shared prosperity has always been a wish to be fulfilled. The global communities have regarded poverty alleviation as a fundamental goal of human rights protection. In 2000, the Millennium Declaration of the United Nations (UN) proposed to identify the alleviation of poverty, hunger, disease, and illiteracy as the global Millennium Development Goals (MDGs). In 2015, the United Nations issued the "2030 Agenda for Sustainable Development Goals (SDGs)", in which "eliminating all forms of extreme poverty" ranks first among the 17 sustainable development goals. These two global actions reflect the extensive concentration on poverty across the world.

China is the largest developing country in the world, which has been plagued by poverty for a long time. Poverty in China is characterized by its large scale, wide distribution, and varying degrees. In 1990, based on the poverty standard of USD 1.9 per person per day set by the World Bank, China's impoverished population accounted for 66.3% of its total population and 36.2% of the world's population in extreme poverty. In 2014, the rural poor population in China was mainly distributed in the mountainous and hilly areas along the HU Huanyong Line, which was first proposed by a Chinese population geographer HU Huanyong in 1935 to reveal the significant differences of population distribution between the two sides of the HU line. In 2014, the proportions of the poor in the northwestern and southeastern regions of the HU line were 16.4% and 83.6%, respectively (Figure 1).

Compared with the eastern coastal areas of China, many districts and counties in the central and western regions are still in poverty, confronted with challenges of fragile natural environment, lagging infrastructure, and insufficient endogenous power. Moreover, as poverty alleviation and economic development continue, areas along the roads and rivers with better geographical conditions have taken the lead in eliminating poverty. The remaining impoverished population was concentrated in the rural rocky mountainous, disaster prone and ecologically fragile areas in central and western China. Among them, more than 80% of China's impoverished counties are located in ecologically fragile areas with poor living conditions and low socio-economic status.

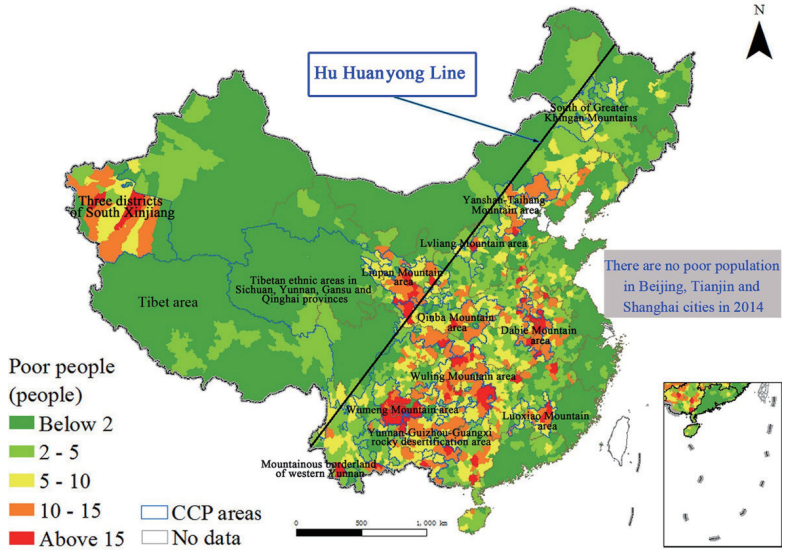



Figure 1 Distribution of China's rural poor population at the county level in 2014

(Notes of typical poor areas: 1=Three districts of south Xinjiang, 2=Lvliang Mountain area, 3=Tibet area, 4=Yanshan-Taihang Mountain area, 5=Liupan Mountain area, 6=Yunnan-Guizhou-Guangxi rocky desertification area, 7=Wumeng Mountain area, 8=Tibetan ethnic areas in Sichuan, Yunnan, Gansu and Qinghai provinces, 9=Mountainous borderland of western Yunnan, 10=Wuling Mountain area, 11=Luoxiao Mountain area, 12=Qinba Mountain area, 13=South of Greater Khingan Mountains, 14=Dabie Mountain area)

# 1.2 Milestone of Poverty Alleviation in China

The stage of poverty alleviation in China corresponded to the economy and management capacity. Since the establishment of the People's Republic of China (PRC) in 1949, national poverty alleviation efforts have gone through a process of six steps (Bikales, 2021; Guo et al., 2019; Wang and Hu, 2020), which include:

| | |
|---|---|
| 1949 → 1977 | Poverty alleviation through the social development of land reform and income redistribution from 1949 to 1977 |
| 1978 → 1985 | Poverty alleviation through national structural reform from 1978 to 1985 |
| 1986 → 1993 | Strategic development-driven poverty alleviation from 1986 to 1993 |
| 1994 → 2000 | Problem and priority-oriented poverty alleviation from 1994 to 2000 |
| 2001 → 2012 | Consolidating poverty alleviation on food and clothing from 2001 to 2012 |
| 2013 → 2020 | Targeted poverty alleviation (TPA) from 2013 to 2020 |

This historical process reflects the shifting of Chinese state policy from regional socio-economic development in poor areas to precise poverty alleviation by targeting the poor households. The evolution of antipoverty policies follows the logic of "solving food and clothing" before "comprehensively well-off", and "regional promotion" before "targeted breakthrough" (Liu et al., 2018; Wang et al., 2016), which coincides with the stages of China's socio-economic development and is in line with China's poverty situation.

# 1.3 Main Achievements of Targeted Poverty Alleviation

On 25 February 2021, the Chinese government officially declared that China had won a comprehensive victory in the fight against poverty. From 2013 to 2020, a total of 98.99 million poor people, 128,000 poor villages and 832 targeted poverty counties, have been lifted out of extreme poverty, which means the extreme poverty has been eliminated nationwide.

At the economic level, the transportation infrastructure was adequate, the industrial structure was obviously improved, the efficiency was constantly increased, the employment channels were increasingly abundant, and the people's income was growing rapidly. At the social level, essential public services such as education, medical care, and social security in poor areas were significantly improved. At the environmental level, the habitat of rural areas was greatly improved. Substantial progress was made in eco-environmental protection and restoration, and the quality of ecological governance was continuously improved (The State Council Information Office, 2021). These remarkable achievements have made China the first developing country in the world to achieve UN Millennium Development Goals, 10 years ahead of the target date of the UN SDGs, creating a great landmark in the history of global poverty alleviation.

# Targeted Poverty Alleviation (TPA) in China

# Chapter 2

# 2.1 General Requirement of TPA

Uplifting people out of poverty is not only a shared dream of humankind, but also a global issue for all countries. Since 2012, China has established a registration system to identify the poverty households accurately. Furthermore, "six precisions" and "five batches" were proposed, and a strict assessment system has been implemented to balance the government support with the demand of the rural poor (Figure 2). China's TPA policy contains five paradigms: science-based theories, institutional designs, extensive practices, strong aid teams and diverse outcomes. These paradigms have become powerful driving forces and necessary guarantees for China to win the battle against poverty, and can be shared with the world.

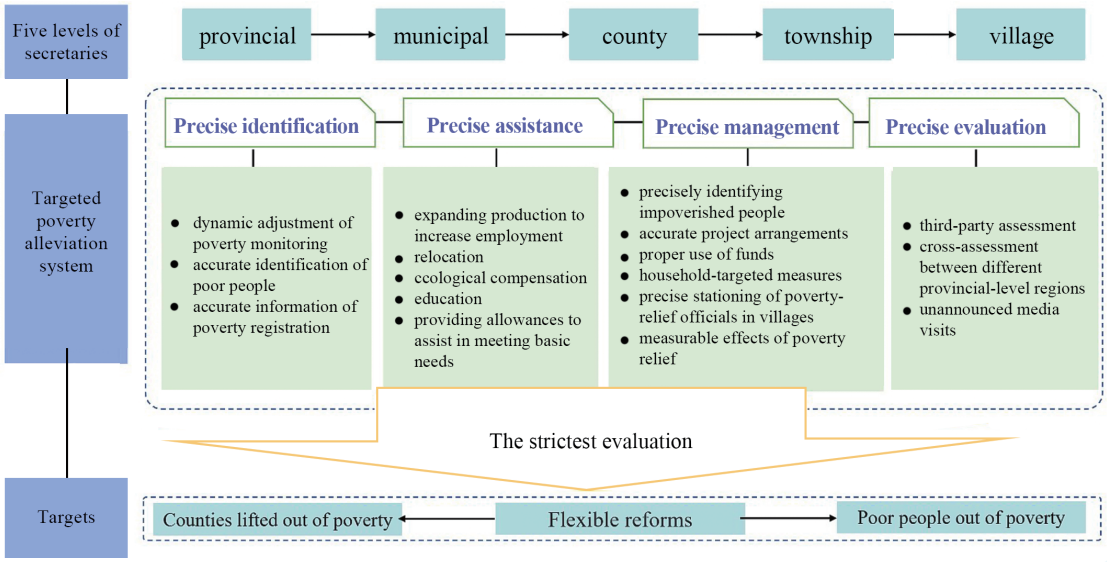



Figure 2 Working mechanism and targets of targeted poverty alleviation

TPA implementation in China includes four key actions: precise identification, assistance, management and evaluation. Precise identification is the prerequisite, precise assistance is the essential factor, precise management is the guarantee, and precise evaluation is the technical tool.

Since 2012, China has developed a registration system for the precise poverty identification of individual households. In the precise identification, poor households are identified based on their income. At the same time, it also aims to ensure "that the poor people in rural areas are free from worries over food and clothing, and have access to compulsory education, basic medical services, and safe housing" (The Central Committee of the CPC and the State Council, 2011; Bikales, 2021; World Bank, 2020). In this way, poor households are identified through application by farmers, democratic deliberation, public announcement and verification, and a nationwide information system was established for TPA. The implementation units should closely track and dynamically adjust the data, timely eliminate inaccurate records of poor households, update the newly identified households to ensure the accuracy of poverty identification.

The precise management is also known as the "Precise efforts in six categories", which covers: identifying the poor, launching targeted programs, utilizing capital efficiently, taking household-based measures, and replacing first-party secretaries based on village conditions and failure to meet the set goals. A rigorous assessment system was put in place to fill the gap between government support and the needs of poor rural areas.

# 2.2 | Main Models of TPA

The focus of precise assistance is to seek truth from facts, provide guidance on classification, and implement appropriate policies according to different situations by considering the people and natural environment, the causes of poverty, and the types of poverty. In practice, China has adopted, categorized, and targeted measures based on the situations of individual households, local environment, and the causes for and types of poverty (Liu, 2021). In this regard, five targeted measures are implemented (Yang et al., 2020):

1) Boosting local economy to provide more job opportunities

2) Moving poor people out of barren areas

3) Compensating for economic losses related to reducing the ecological damage

4) Improving the education in impoverished areas

5) Providing subsistence allowances for those unable to be uplifted out of poverty only by their own efforts

In the management system, China has established a working mechanism in which the central government takes overall planning, the provinces take the leading responsibility, and cities and counties are in charge of implementation. China's TPA practices have constructed a multi-sector cooperation with the government as the leading force, the market as the main force, and the society participating and collaborating. Industrial development, employment transfer, relocation project, ecosystem service, science and technology, education, financial support, health project and other factors of poverty alleviation are then organically combined (Figure 3). This has formed a social poverty alleviation system with multiple subjects across the regions, departments, units, with the participating of whole society to guarantee the continuity and effectiveness of poverty alleviation measures.

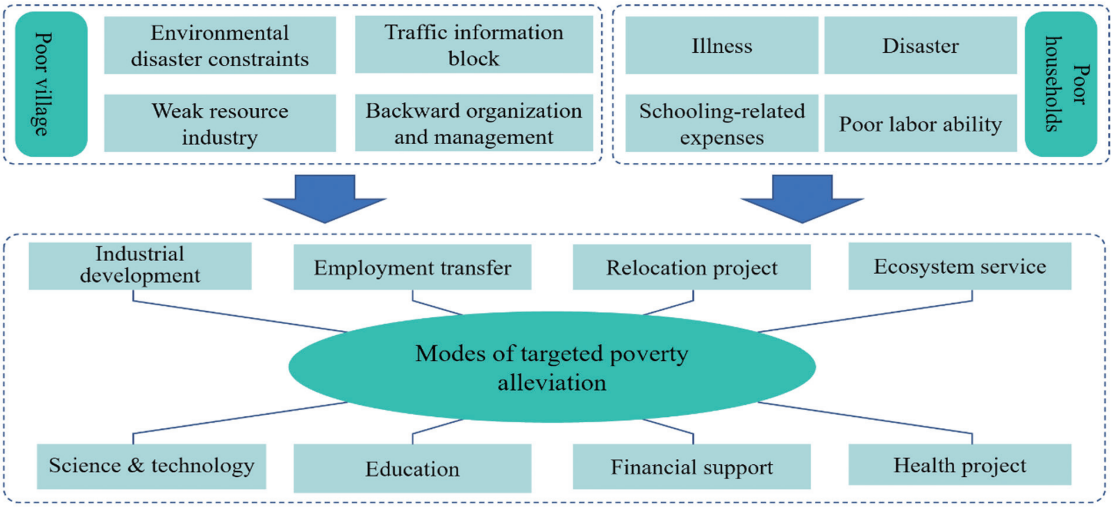
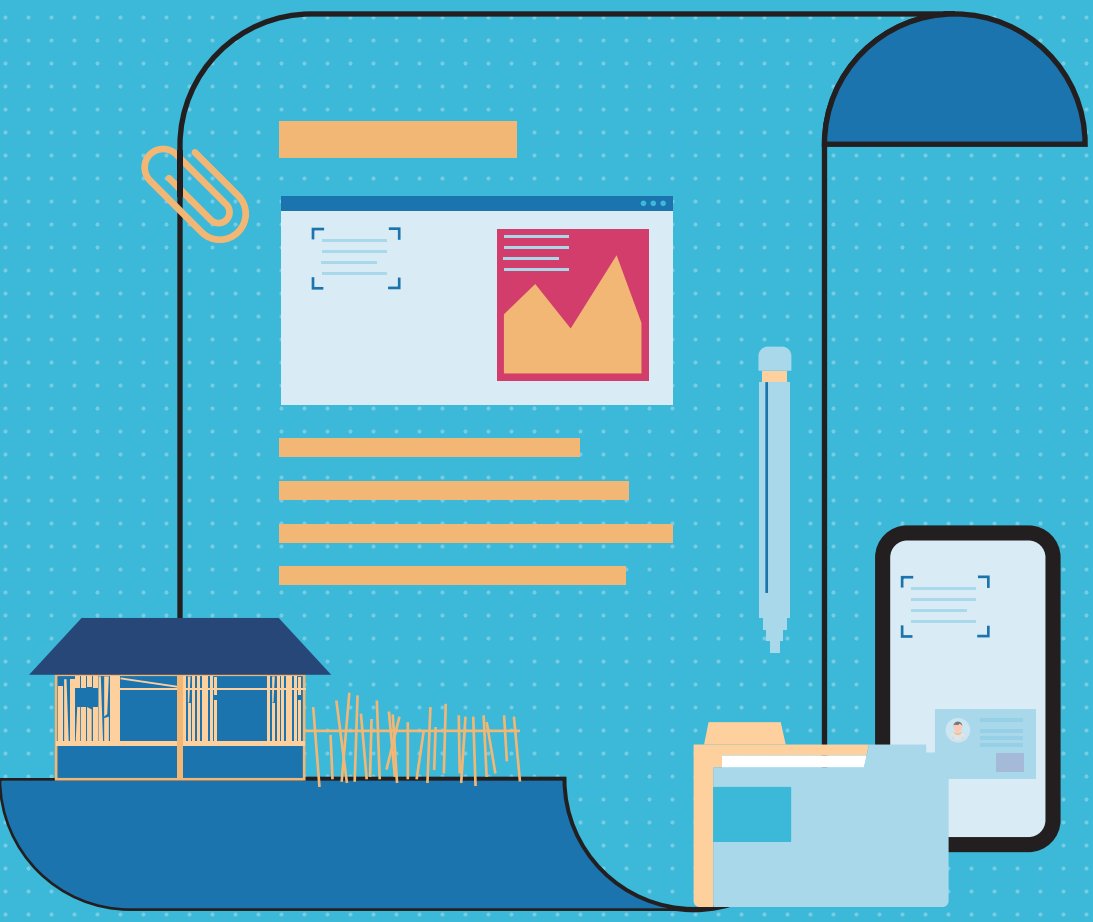



Figure 3 Main modes of precise assistance

## 2.3 | Evaluation of Effectiveness of TPA

In February 2016, Chinese State Council issued the *Measures for Assessing the Effectiveness of Poverty Alleviation of Provincial Party Committees and Governments* to commit relevant scientific research institutions and social organizations to conduct annual assessments of the effectiveness of poverty alleviation by various special surveys, sample surveys and field verification.The precise evaluation is an essential tool to enhance the effectiveness of TPA while implementing the policies and projects, to ensure that the poverty alleviation is pragmatic and solid, and that the results are true and valid. Typical three methods include third-party, inter-provincial and unannounced media assessments. The third-party participation in precise evaluation helps to ensure the independent, objective, impartial and scientific investigation and assessment of TPA, which fully reflects the overall progress of poverty alleviation work (New China Research Xinhua News Agency, 2021). It reveals the main problems in implementing TPA policies and guidelines, and promotes the flexible reforming in decision-making and scientific management of TPA through in-depth evaluation, which have effectively improved the accuracy, effectiveness, and sustainability of poverty alleviation practices in China.

# Practices and Experiences on Poverty Alleviation Conducted by Chinese Academy of Sciences



# Chapter 3

**As a national institution, the Chinese Academy of Sciences (CAS) has always taken poverty alleviation as a crucial task with its leadership in science and technology, especially in promoting TPA and its impact assessment. To meet the pressing national needs, an unincorporated research organization called "Center for Assessment and Research on Targeted Poverty Alleviation" was established by CAS in 2016, to carry out the third-party annual assessment. CAS is fully engaged in developing the TPA indicator system and implementing key technologies in local practices. In addition, the China Urban-Rural Development Think Tank Alliance (CURTA) was established in 2015. The Alliance of Poverty Reduction and Development of the Alliance of International Science Organizations (ANSO-APRD), was initiated in 2020 to strengthen the multi-sector exchanges and cooperation, and to promote multi-disciplinary studies to support decision-making at different levels.**

**A series of practical and successful models were developed by CAS groups (Bai, 2020; Hou, 2020), such as the "Fuping Model" on land consolidation in Fuping County of Hebei Province, and the "Kenfu Model" through ecological migration in Huanjiang Maonan Nationality Autonomous County of Guangxi Province. The details are shown below.**

## 3.1 Fuping Model on Land Consolidation in a Remote Mountain Area of China

Poverty alleviation in poor rural areas is always faced with shortages of land, capital, technology and talents, as well as the dilemma of environmental conservation and economic development. The "poverty belt" in Hebei Province refers to the poor counties bordering Beijing and Tianjin. One of them, Fuping County, combines the characteristics of remote mountains, poverty and old-fashioned ideas. If the county was divided into 10 equal parts, nine would be covered by mountains. The remaining tenth would be half water and half farmland. The barren mountain is a typical landscape in Fuping County, which is both difficult to utilize (resource-type poverty) and faces environmental protection constraints (ecological-type poverty) (Zhou et al., 2019). Implementing the targeted poverty alleviation in remote mountainous areas, and identifying breakthroughs to solve the main problems are the top priority for scientists. Given its academic expertise and extensive cooperation network, IGSNRR/CAS took the lead in organizing a team of experts in agriculture and rural development in May 2014, and submitted a proposal titled "Developing Characteristic Industries based on the Existing Mountain Resources in Fuping County". Then the "Demonstration Station for Targeted Poverty Alleviation and County Development in China" was jointly established. Prof. LIU Yansui from IGSNRR/CAS and his team, have developed a comprehensive land consolidation model to promote poverty alleviation and transformative rural development in Fuping County. Fuping County promotes the land consolidation

of barren mountains as a breakthrough to lift the local people out of poverty. Land transfer practices are adopted by reclaiming and consolidating the unused land into high-standard farmland for the high-efficiency agriculture in Fuping. Therefore, as the results of the land transfer and consolidation, barren mountains become assets, infrastructure is shared, and farmers become shareholders (Guo and Liu, 2021; Zang et al., 2019). In China, there are 832 impoverished counties located in remote mountainous areas. As a result, land consolidation has become a typical model for increasing the livelihood, restoring the eco-environment, and assisting in poverty alleviation in these areas.

Based on previous experiences with land consolidation and local community (village) surveys, LIU Yansui's team proposed a utilization-oriented comprehensive land consolidation model for Fuping, which clarified the tasks and responsibilities of multiple stakeholders with "government as a leader, community as a supporter, farmer as a shareholder, and enterprise as a market operator". This model integrates land consolidation, optimal land allocation, and characteristic agriculture development (Wu et al., 2019). It creates significant social, economic and ecological benefits by broadening the employment and income-generating channels and solving the employment problems of women and elderly people left behind in those poor areas.


Figure 4 Comparison before and after land consolidation in Fuping County

Land consolidation is the prerequisites of rural poverty alleviation in the Fuping model, and the development of a circular economy is the key here. Liu's team applied a resource recycle model of "forest and fruits – edible fungi – organic fertilizer" based on the local natural environment and traditional agriculture in Fuping (Figure 5). This resource recycle model not only improves the productivity and income of local farmers but also ensures the green and high-quality development of Fuping county. Through comprehensive land consolidation and development of characteristic industries, Fuping County has lifted 6,144 households and 19,207 individuals out of extreme poverty, stabilized the low-income families' employment, significantly improved the poor households' income, and effectively helped alleviating local poverty with precision identification, assistance, and management. In addition, the area of cultivated land has been extended with improved soil and water quality. This practice has laid a solid foundation for farmers' income, stable employment, targeted poverty alleviation, and modern agricultural development (Liu and Wang, 2019).

Figure 5 Shaking off poverty and increasing farmers' income through land consolidation

# 3.2 Kenfu Model on Ecological Migration in the Karst Landscape of Southwest China

Located in Guangxi Zhuang Autonomous Region, Huanjiang Maonan Autonomous County (hereafter as Huanjiang County) suffers from extreme poverty due to its fragile natural karst landscape and low resource carrying capacity. To strengthen the research capacity on the Karst ecosystem and support an environment-friendly economy in the region, the Institute of Subtropical Agriculture (ISA) of the Chinese Academy of Sciences (CAS), the Department of Science and Technology of Guangxi Zhuang Autonomous Region and the Office of Poverty Alleviation and Development jointly proposed the "Kenfu Model" to eliminate poverty through village relocation efforts.

In 1996, researchers from ISA/CAS visited Huanjiang County to help local poverty alleviation actions. Following in-depth surveys and analysis of local households, Prof. WANG Kelin and his team came up with an ambitious idea of relocating the low-income families to Kenfu Village, a demonstration base three kilometers north of the Huanjiang County (Wang et al., 2020). They also aimed to activate a multi-sectoral cooperation system that included research institutes, companies, demonstration bases, and industry. CAS and Huanjiang County first set up the Kehuan Poverty Alleviation Development Company (hereafter as Kehuan Company). CAS conducted research projects to support the main local products such as fruit, sugar cane, livestock, and vegetables in the demonstration base. Kehuan Company was responsible for infrastructure, operations, management, technical training, seedling supply, and product sales, providing all-in-one services for the resettled farmers. Instead of receiving relief funding from the government, the resettled farmers contracted land and applied for loans to buy agricultural materials. Through this "Kenfu Model", more than 200 hectares of land in the demonstration base have been used rationally to form an industrial system based on agricultural products such as fruits, sugar cane, and vegetables (Figure 6).

Figure 6 The Kenfu Village before (left, 1996) and after (right, 2003) ecological migration in Huanjiang County

Furthermore, new high-quality green development models that combine agriculture and animal husbandry are proposed and practiced on more demonstration bases. Based on research of the Karst ecosystem, WANG Kelin's team proposed a "planting grass to raise cattle" model (Figure 7) to ensure the improvement of local livelihood and environment conservation. In Guzhou and Xiatang Villages, various demonstration bases were established. Some were based on returning the farmland to forest and grassland, breeding cattle, growing mulberries, and raising silkworms, and planting ecological forestry. A total of 91 households are engaged in managing 2,770 square meters of cattle sheds and 34 hectares of high-quality pasture land. To help inactive households out of poverty, WANG Kelin's team also proposed a creative "loan for cattle" model. Poor households can raise beef cattle with interest-free loans or they can be entrusted to family farms or cooperatives and get dividends after the cattle are sold. However, animal husbandry increased farmer's incomes but brought environment problems caused by livestock waste. In response to these problems, Huanjiang County carried out a demonstration base that used an aquatic plant, Myriophyllum elatinoides Gaudich, for sewage treatment, and the water quality reached Grade III of the national standard. This demonstration model has been incorporated into the rural environmental treatment scheme of Guangxi Autonomous Region and has been widely popularized.

Figure 7 Development of understory grass planting (left) and cattle raising industry (right)

After two decades, the Kenfu demonstration base has achieved remarkable progress from economic and ecological perspectives. The per capita net income of residents of the Huanjiang demonstration base increased from less than RMB300 (US$44) in 1996 to RMB14,660 (US$2,174) in 2019, and the development of eco-environmental activities such as animal husbandry, farming and processing medicinal herbs lifted 4,000 farmers out of poverty. Praised as the "Kenfu Model" by UNESCO (The United Nations Educational, Scientific, Cultural Organization) experts, it has created a new concept of eco-environmental poverty alleviation in Huanjiang County, provided the scientific basis and technological support for the Huanjiang program to relocated 100,000 poor people (the largest eco-migrant resettlement county in China), and served as an excellent model for similar large-scale relocations.

# 3.3 Third-party Assessment for TPA Precise Evaluation

TPA focuses on establishing an effective working mechanism through a series of policy measures to reduce the impoverished population and eliminate poverty effectively. Therefore, precise evaluation is of great significance to quantitatively assess the performance of poverty alleviation at all levels and for relevant responsible stakeholders. The third-party assessment is one of the most efficient ways to support TPA implementation in China. It is the earliest and largest assessment in the history of global poverty reduction. With the participation of professional and independent organizations, the third-party assessment makes up for any deficiency of the internal review by the government (Figure 8). Based on its rich talent resources and comprehensive capacity in science and technology development, CAS has played a significant role in organizing the third-party assessment, building the indicator system, and conducting the key research and technology for a precise evaluation (Liu, 2021).

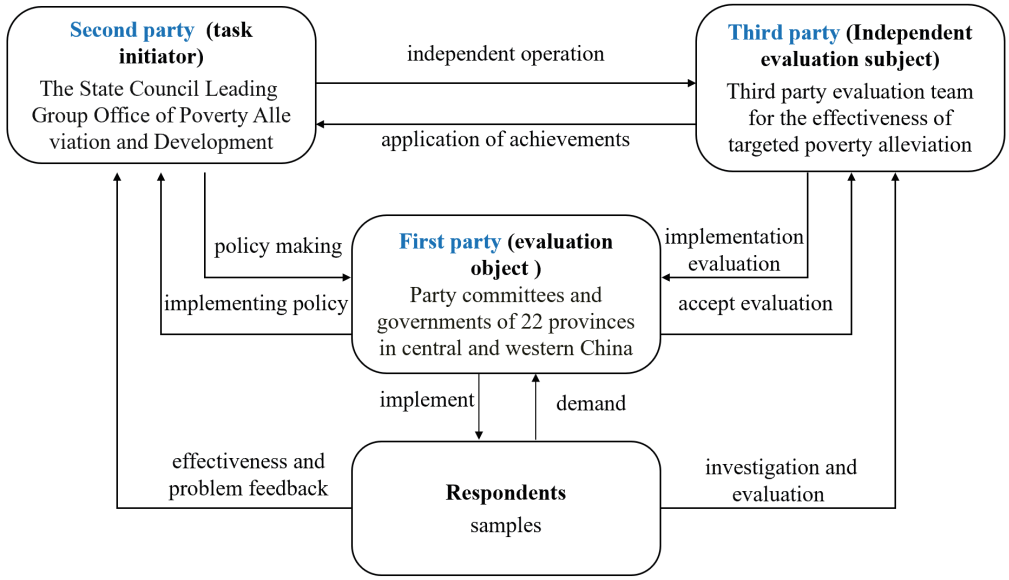



Figure 8 Tasks and responsibilities of the third-party assessment for national TPA effectiveness

## High-quality data collection.

The core members of the investigation team will be trained before each assessment to ensure that they use the same data standards, follow the same technical manual, and work under the exact requirements. Then, they will train other members in turn (Figure 9). During the investigation, a set of general methods have been developed. For example, the investigators have six steps to investigate the households, i.e., observing the houses, grain, labor force, schooling, the stability of income, and people's approval. A series of regulations and rules were established to ensure the authenticity and reliability of data obtained from surveys and observations to avoid interference from local governments. For example, during the investigation, the local government staff are not allowed to visit the counties; the county government staff are not allowed to go to the towns, and the town government staff are not allowed to visit the villages; local people are not allowed to accompany the investigators during the household survey. In addition, the information about locations and households being investigated will not be released to local staff until 10:00 pm the night before a survey. Sometimes, the investigators will make random changes right before the survey to ensure the objectivity and authenticity of the data.




Figure 9 Household survey processing of the third-party assessment

## Scientific theories and the key technologies support.

Researchers and experts put forward scientific theories and key technologies to guarantee a smooth implementation of the third-party assessment and improve its efficiency and quality (Figure 10). Professor LIU Yansui proposed the "Poverty Island Effect" theory (Figure 11) (Liu et al., 2017) revealing the pattern of localized poverty caused by a chronic lack of exchange of goods, information, and people with the outside, which is the result of closed and semi-closed environments. In implementation the poverty alleviation, it was found that areas along roads and major rivers took the lead in eliminating poverty. However the remaining population in impoverished villages is concentrated in less developed areas far from cities with frequent natural disasters and limited water and soil resources. This presents a state of relative clustering, closure and isolation, showing the island effect of poverty (Liu et al., 2017; Yang and Liu, 2021). The island effect of rural poverty reflects the characteristics of regional enclosure, spatial agglomeration and diversity, which requires more effective and precise TPA in these regions. Prof. LIU Yansui proposed the theory of "Diminishing Marginal Effect of Poverty Alleviation", pointing out that poverty alleviation in some areas will gradually diminish over time and more targeted and precise solutions for local people are needed. Rural poverty alleviation seeks to match the supply of government support

and the needs of rural poor (Figure 12) (Liu and Cao, 2017). The heterogeneity of different regions and their poor counties, impoverished villages and households, determines the differences in the supply structure and the diversity of needs for poverty alleviation. These theories provide scientific bases for the assessment methodology of TPA. Prof. ZHOU Chenghu from IGSNRR/CAS carried out new poverty alleviation research on spatial information analysis and policy-making advice by integrating various technologies on geographic information, remote sensing, and spatial positioning. Moreover, ZHOU's team developed a real-time data collecting system through mobile phones, a PAD-type real-time monitoring & management device, namely the "Precise Evaluation Device" (*Jingpingtong* in Chinese) (Figure 13), was created by integrating all the information from high-resolution remote sensing, spatial positioning, household survey, video, audio, photo and mobile data to support the real-time data input, transfer, management, analysis, and simulation (Zhang, 2020).

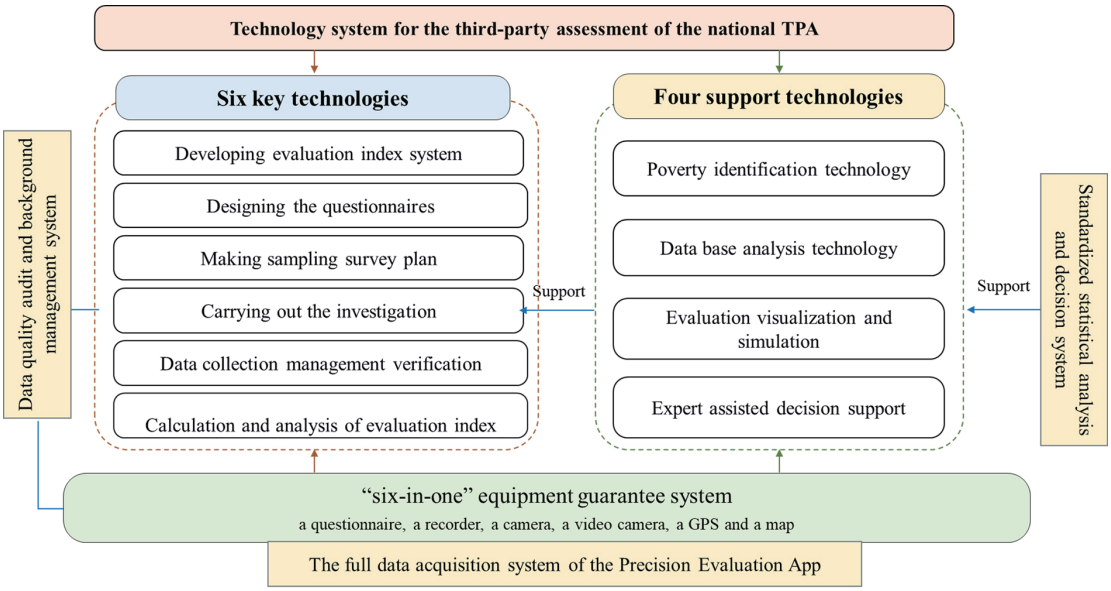



Figure 10 Technical methods of the national third-party assessment on the effectiveness of targeted poverty alleviation

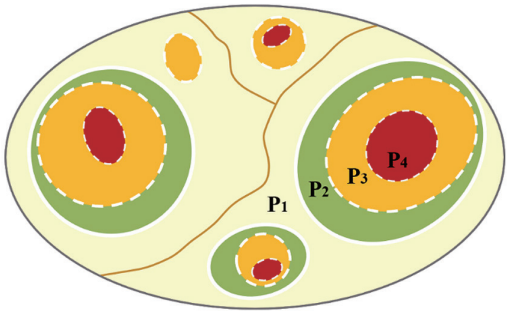



Figure 11 The isolated island effect of rural poverty

(Note: P1 is the stage of overall regional poverty when it is appropriate to adopt developmental poverty alleviation and whole-village promotional measures. P2 is the precise identification stage. P3 requires both precise identification and targeted assistance and emphasizes production development to facilitate precise poverty eradication. P4 stage refers to severely impoverished counties and townships or unique poverty-stricken villages.)

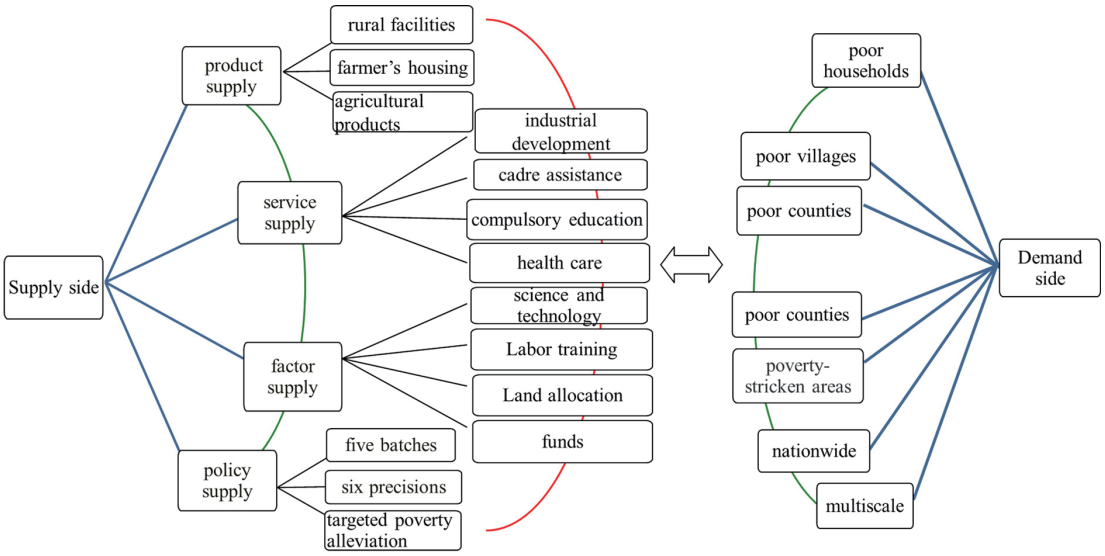



Figure 12 Supply-side structural system of targeted poverty alleviation

Figure 13 The "Precise Evaluation Device" developed by the third-party assessment team

## Assessment standard and indicator system development.

Based on the basic theory of rural poverty in China and the principle of TPA, and under the requirements of the *Measures for Assessing the Effectiveness of Poverty Alleviation and Development Work of Provincial Party Committees and Governments* (The Central Committee of the CPC and the State Council, 2020), the third-party assessment of the effectiveness of the national TPA work focused on two significant aspects, namely precise identification and precise assistance. Among them, the assessment indicators for precise identification include the accuracy rate of poverty identification and the accuracy rate of poverty deregistration, while the assessment indicators for precise assistance include public satisfaction with the assistance work (Figure 14). In addition, the third-party assessment team established unified standards and manuals to ensure the transparency and accuracy of the processes and results. The standardization and consistency of third-party assessment were reflected in five aspects, such as spatial sampling plan, assessment standard, questionnaire, technical manual, and business training to ensure that the process can be tracked, the scenes can be restored, the results can be compared, and the quality can be guaranteed.

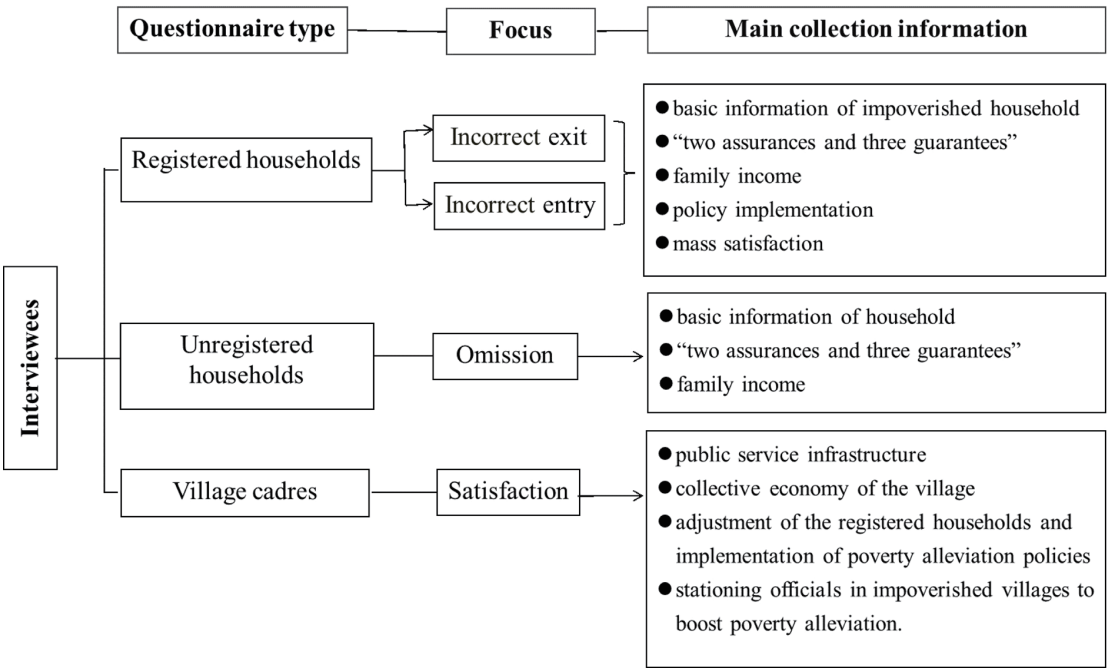



Figure 14 Questionnaire collection information

## Sampling, information collection, and quality control.

The sampling scheme for the third-party assessment was designed with due consideration of the physical and ecological characteristics, socio-economic conditions, and household livelihoods. Within a province, some counties representing its typical geographical and ecological characteristics were selected for sampling. Within a county, villages were randomly selected for sampling based on specific types and severity of poverty. Within a village, the number of households in each category of the sampled villages was decided based on the size and composition of registered households (the proportion of households in poverty and the proportion of households out of poverty) and the individual differences between farm households in the sampled village. The sampling scheme of "poverty-stricken counties – villages – households" was built to ensure the full coverage of survey data, representativeness, and authenticity. In addition, the assessment teams developed a standardized statistical analysis and decision-making system to ensure the authenticity and quality of the assessment, an online data collection system, a data quality verification, and a back-office management system.

During the field survey, a multi-source data collection system combined with Precision Assessment App (app) was used to collect the information on spatial location, courtyard photos, survey videos, and interview audio to facilitate the data cross-validation afterwards (Figure 15). After the field surveys, the provincial survey teams took the responsibility of the preliminary data quality check. The checked data and key information of the households with incorrect registration, deregistration, and omission were uploaded to "The National Third-party Assessment platform on the Effectiveness of Precise Poverty Alleviation" (Figure 16). Through systematic quality checks, data logic conflicts and errors can be eliminated, and date completeness and accuracy are guaranteed.

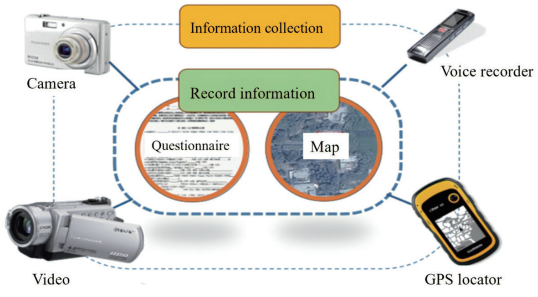



Figure 15 "sixes-in-one" of the assessment and investigation APP


Figure 16 The national third-party assessment platform on the effectiveness of targeted poverty alleviation

From 2015-2020, the total number of experts and scholars participating in the assessment survey was more than 10,000. Moreover, 603 counties, 5,380 villages and more than 160,000 households in 22 central and western provinces were surveyed during this period (Figure 17). Moreover, six appraisal reports, 140 provincial and 12 special consultation reports were submitted (Figure 18). Through the third-party assessment, the accuracy rate of poverty identification increased by 2.1% and the accuracy rate of poverty deregistration increased by 3.2%, and the public satisfaction rate increased by 10.7% during 2016-2020. The third-party assessment has promoted more accurate identification and precise assistance to villages and households, and more effective implementation of policies based on individual poverty, effectively playing the role of a quality checker, a baton, and a propeller for poverty alleviation.

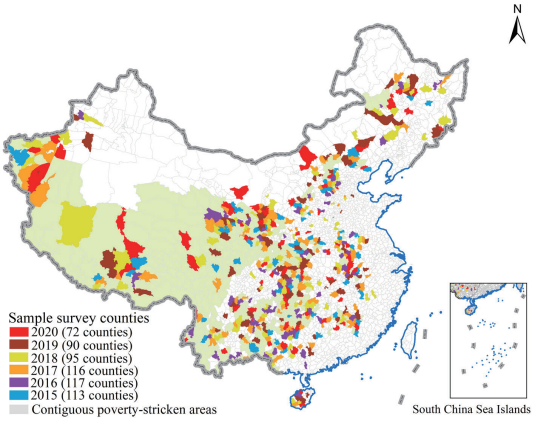



Figure 17 Spatial distribution of the sampling counties in the national third-party assessment on the TPA effectiveness during 2015-2020

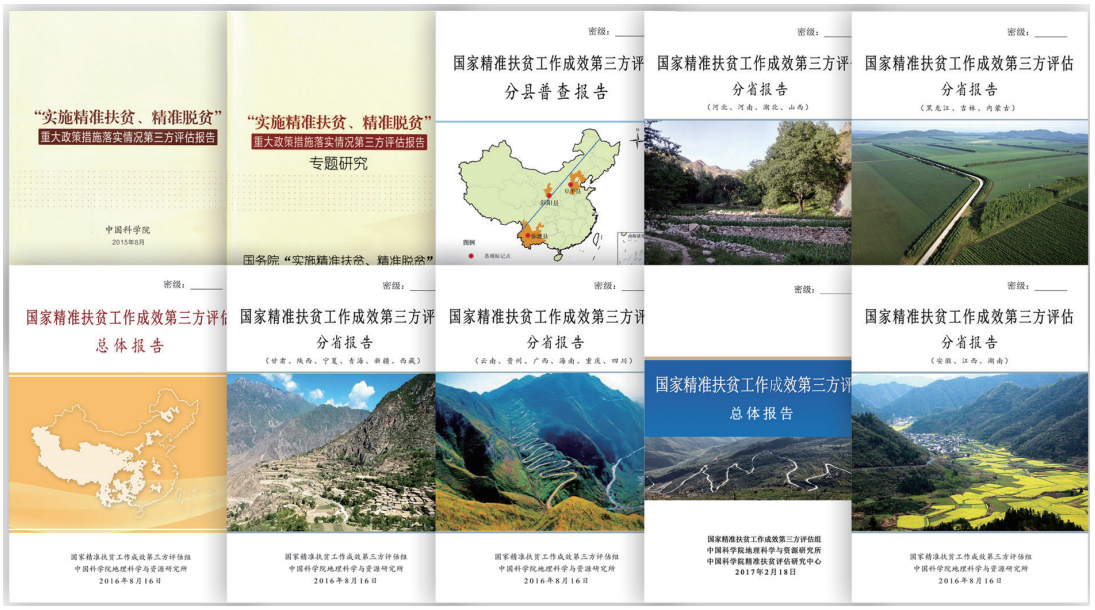



Figure 18 Third-party assessment reports on the effectiveness of national targeted poverty alleviation

## Multi-discipline integration and social impacts.

National third-party assessment of the effectiveness of targeted poverty alleviation adheres to the principles of independence, objectivity, fairness and science-based, and it applies professional theories to guide the evaluation practices. The third-party assessment develops professional theories through evaluation and decision making processes, and practices the multi-discipline integration from theoretical research, technological innovation, and economic development to local decision-making.

Mr. WANG Yang, then Vice Premier of the State Council, head of the State Council Leading Group for Poverty Alleviation and Development, acknowledged the third-party assessment as "the biggest movement of the educated youths to countryside and mountain areas in the 21st century". The achievements of third-party assessment were reported by CCTV, CGTN, IGU, etc. The team from IGSNRR/CAS, was awarded the "National Advanced Collective for Poverty Alleviation" by the State Council (Figure 19-20), and won the Science and Technology for Development Award of Chinese Academy of Sciences.


Figure 19 Certificate of "National Advanced Collective for Poverty Alleviation"


Figure 20 Medal of "National Advanced Collective for Poverty Alleviation"

# Recommendations to Developing Countries in the Belt and Road Region

# Chapter 4

International cooperation on poverty alleviation in the Belt and Road regions is an important component of global efforts, because most of the developing countries are located in these regions. Obviously, China's successful experience in poverty alleviation can provide valuable reference and inspiration for other countries. China's poverty alleviation efforts have been supported by a national long-term development strategy over the past decades. Its great success is built on active participation of every sector and stakeholder in poverty alleviation. Science and technology can be essential in designing, implementing, assisting, and evaluating poverty alleviation. Top-down and bottom-up approaches are conducted to improve poverty alleviation's efficiency and capacity. Based on the solid and effective poverty alleviation strategy through science and technology, and the practices of evaluating the effectiveness of targeted poverty alleviation, the following five aspects towards 2030 UN SDGs are suggested in this report.

1) Creating a safe and inclusive environment for poverty alleviation and socio-economic development. A stable domestic political situation is the basis for long-term poverty alleviation to ensure sustained poverty eradication efforts and socio-economic development. Joint actions with the UN and other international organizations are highly recommended in unstable and less developed countries.

2) Building international communities on targeted poverty alleviation with joint assistance and knowledge sharing. Developing countries should strengthen the consensus and work together to build an international system for precise identification of the poor, as well as precise assistance and management including investment, training, infrastructure construction, medical care, and scientific and technological services.

3) Launching diversified and open assistance programs for poverty alleviation. The assistance scheme for poverty alleviation is a multi-sector and multi-disciplinary approach that needs to involve main stakeholders from governments, communities, households, S&T institutes/agencies, and enterprises. Specific requests such as investment, labor training, infrastructure construction, and medical assistance must be considered to meet the diverse needs of poor people.

4) Establishing a multidimensional and dynamic poverty alleviation assessment system. Rural poverty alleviation seeks to match the supply of government-support to the needs of rural poor (Yang and Liu, 2021). It is necessary to follow the "isolated island effect" theory and the "supply-side structure" principle, and establish a multidimensional monitoring and dynamic assessment system on rural poverty in the Belt and Road regions.

5) Developing an integrated and coordinated poverty alleviation strategy. Given the development stages and natural

environment differences, the suggested strategy is to promote the comprehensive development of rural transition, targeted poverty alleviation and rural revitalization by making integrated plans, providing guidance and assistance. Then it is necessary to create sufficient opportunities for industrial development, employment and income increase to improve the livelihoods of marginally poor groups and provide a solid foundation and lasting momentum for the development of deep poverty-stricken villages.

6) Enhancing the international cooperation for poverty alleviation on ANSO platform. The Alliance of Poverty Reduction and Development (APRD) was officially approved by the Alliance of International Science Organizations (ANSO) in 2020, with 14 founding members from 10 countries/regions, including Institute of Rural and Agricultural Development, Polish Academy of Sciences, The University of Auckland, Research Centre for Astronomy and Earth Sciences Geographical Institute, Hungarian Academy of Sciences, Asian Institute of Technology (Thailand), National Higher Education, Science, Research and Innovation Council (Thailand), University of Gauhati (India), Sindh Agriculture University Tandojam (Pakistan), City University of Hong Kong (Hong Kong, China), National University of Laos, and Kunming Branch Chinese Academy of Sciences as well as municipalities of Puer, Lincang and Yanchi county. The aim of the alliance is to promote research collaborations, sharing experiences and scientific exchanges as well as training of poverty reduction and sustainable development among countries in the "Belt and Road Initiative" region. APDR is the operating arm and driving forces of ANSO to work with ANSO members, partners and international organization on regional and global poverty alleviation.

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