

Article

Protecting Traditional Agricultural Landscapes by Promoting Industrial Integration Development: Practices from Important Agricultural Heritage Systems (IAHS) Sites in China

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Abstract: Traditional agricultural landscapes (TAL) have a long history. They have received significant attention due to concerns regarding their multiple functions and scarcity. Important Agricultural Heritage Systems (IAHS), designated by the FAO or some countries, are typical TAL that are facing conservation problems. This study takes IAHS as an example and examines the pathway and coordinating mechanism that industrial integration development (IID) uses to promote TAL conservation using available literature reviews and field surveys in IAHS sites. The findings suggest that the main pathways protecting IAHS, depending on IID, include increasing product price by IAHS branding, diversifying farmers' income by developing special resources, and employing more seasonal surplus laborers by extending local industrial chains. Building a fair and reasonable benefit coordination mechanism among stakeholders in IID is crucial to prompt IAHS conservation. It rests on accurately identifying key stakeholders in IAHS conservation, selecting industrial organization modes that are suitable to an IAHS site, and introducing beneficial distribution mechanisms that can encourage farmers to stay on the farm. The case studies show that diversifying income channels and increasing income with industrial development are the main forces driving farmers to protect IAHS. The IID based on IAHS resources and the win-win benefit distribution principle are key to sustainable conservation.

Keywords: sustainability; labor productivity; nationally important agricultural heritage system (NIAHS); small farmer; agricultural landscape



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1. Introduction

Agriculture has multiple functions, including food and fiber production, ecology, society, culture and food security [1,2]. With the development of industrialization and urbanization, the multi-functional value of agriculture has become increasingly prominent. In the agricultural age, agriculture had ecological, social, and cultural functions; however, little attention has been paid to these aspects as the demand for food and clothing has meant that food and fiber production is a priority subject [3,4]. The industrial age saw the migration of rural populations to cities due to the increase in industry. Industrial products, such as chemical inputs and agricultural machines, widely used for agricultural production, transformed diversified traditional agricultural landscapes (TAL) into single and large-scale modern agricultural landscapes [5,6]. Some of these rural landscapes, once used for agricultural purposes, were abandoned and left unattended, turning into forests [7]. The long working hours and the crowded living environments in the cities meant that workers yearned for access to rural spaces where they could be closer to nature. The rural areas where man once harmoniously coexisted with nature, areas characteristic of rural culture and beautiful TAL, gradually became attractions for rural tourism, creating a new non-production function for the agricultural sector that is continuing to increase in value.

Agricultural landscapes occupy the majority of rural spaces and are an important part of the history of rural populations and play a central role in regional culture. Some TAL are hundreds or thousands of years old, reflecting the historic harmonious symbiosis between local people and nature and the related cultural customs formed over centuries [8,9]. Therefore, these sites are protected by the international community. Many conservation actions have been implemented; for example, the Globally Important Agricultural Heritage Systems (GIAHS) initiative launched by FAO in 2002 aimed at establishing an agricultural heritage system including related landscapes, biodiversity, knowledge and cultures around the world [9], the agricultural landscapes in World Cultural Heritage implemented by UNESCO [10] and the World Heritage Irrigation Structures initiated by the International Commission on Irrigation and Drainage (ICID) in 2004 [11]. These initiatives are important measures taken by the international community to protect typical TAL worldwide. In China, the Ministry of Agriculture and Rural Affairs of the People's Republic of China (MARA) launched the Nationally Important Agricultural Heritage System Protection Program (NIAHS) in 2012, aiming to protect those well maintained traditional agricultural systems at the national level. By the end of 2021, there were 138 traditional agricultural systems listed as China-NIAHS. Eighteen of them have been listed by FAO as GIAHS. In addition, the Ministry of Water Resources launched the National Heritage Irrigation Structures in 2021. The identification and designation of these heritage sites plays an important role in the protection of TAL. However, it is urgent to take effective measures to protect these heritage sites after being designated as a heritage.

Agricultural landscapes are the external form of agricultural production systems. Maintaining TAL requires farmers to continue to farm according to traditional methods. This means many stakeholders are involved in taking action to protect these sites. Hence, the protection of TAL is a complex issue and has become an important research subject [8,12–15]. In the past few decades, TAL have been fast disappearing, mainly due to the low input-output rate compared to modern agriculture [16,17]. Scholars generally consider that increasing farmers' income based on agricultural multi-functions is the fundamental way to protect TAL [18–20]. There are two approaches proposed by the relevant literature. One is policy incentives; for example, an ecological compensation policy [21,22] and heritage protection subsidy policy [23]. The farmers, in accordance with traditional agricultural production methods, are given corresponding subsidies to increase their income. The other is through self-development, which fully explores the multiple resource values of TAL; for example, promoting the upgrade of primary industry (developing green, organic and other ecological agriculture) and extending it to secondary and tertiary industries (agricultural product processing and manufacturing, rural tourism, cultural and creative industries, etc.). The income of people in traditional agricultural areas can be increased through industrial upgradation and integration development [23–25]. As TAL need to be maintained by industries based on agriculture, the latter is the more sustainable method. However, TAL are mainly distributed in the relatively backward economic environment and belong to protected sites; thus, industrial development faces multiple constraints. Therefore, exploring effective measures and mechanisms for industrial integration development (IID) for TAL conservation is a globally important issue.

China is one of the main agricultural origin centers in the world; due to its diverse regional climate and its vast territory, the country is home to various types of traditional agricultural landscapes. It is the most important supporter and promotor of the GIAHS initiative and has the most GIAHS in the world [26]. It is also one of the first countries to initiate NIAHS. Regarding the subject of GIAHS and NIAHS (hereafter referred to as IAHS, including GIAHS and China-NIAHS) conservation, numerous studies have been conducted by those who care for IAHS sites and Chinese researchers, attracting governmental officers and researchers from 70 countries to study IAHS conservation [27]. This study will take IAHS in China as the study case to reveal the interaction mechanism between IID and TAL conservation based on a review of the available relevant literature and our field surveys,

in order to enrich the theory of IID promoting IAHS protection and provide practical examples for other regions.

2. Materials and Methods

2.1. Research Logic

To fully examine both the advantages and disadvantages of IAHS conservation in China, as promoted by IID, a theoretical framework was established, and case studies were conducted, respectively. First, we built an analysis framework based on the available literature review to summarize and analyze the related actions taken in different IAHS sites, and then selected two GIAHS sites: Anxi Tieguanyin Tea Culture System in Fujian Province and Longji Terraces of Rice Terraces in Southern Mountainous and Hilly Areas in Guangxi Zhuang Autonomous Region, as the subjects on which to conduct our case studies (Figure 1). The analytical framework can be seen in Figure 1. TAL conservation requires farmers to grow crops according to traditional methods. Farmers are willing to carry out traditional agricultural work according to agricultural methods on the premise that they can earn a higher income. Therefore, it is critical to increase farmers' income through IID based on the resource advantages of IAHS. In the process of promoting IID, two issues that influence the effects caused by the farmers' increase in wage must be resolved. The first is to select a suitable route for IAHS sites; the second is to make an effective multi-stakeholder involvement mechanism. For the IID route, there are different ways to improve farmers' income: for example, raising the price of agricultural products, extending industrial chains and diversifying farmers' employment to increase their income channels. For multi-stakeholder involvement, crucial problems must be addressed: for instance, identifying the core stakeholders, selecting suitable organization modes, and establishing fair and high-efficiency benefit distribution mechanisms.

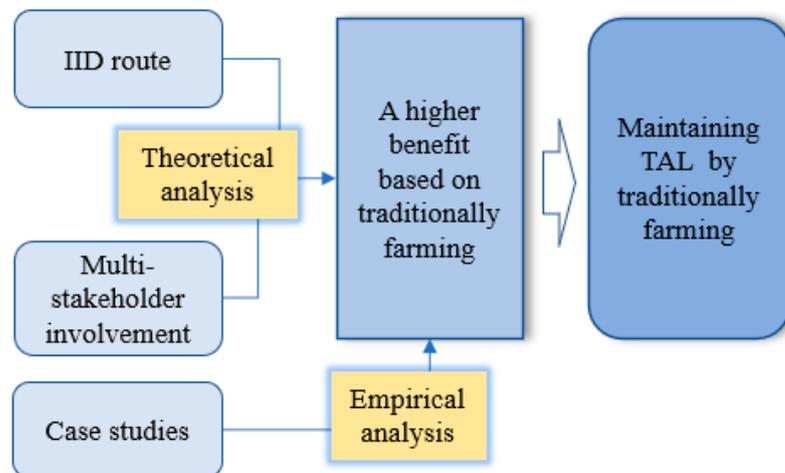


Figure 1. Logic framework of this study.

2.2. Data Collection Methods

In order to obtain complete information that provides evidence that IID drives farmers to protect TAL conservation, a comprehensive method combining literature research and case studies in selected GIAHS sites were used. For an overall theoretical analysis, the relevant data were collected by the channels as follows: first, papers suggesting that IID promotes IAHS conservation published in journals or conferences from China National Knowledge Infrastructure (CNKI) and Web of Science (WOS) were searched. In CNKI, the searched theme words were set as “传统农业景观 (English: traditional agricultural landscape conservation)” or “农业文化遗产 (English: agricultural heritage)” and “产业 (English: industries)” and “保护 (English: conservation)”. Two hundred and thirty-three papers were found. In the core collection of WOS, “traditional agricultural landscape conservation” and “agricultural heritage” were set as the theme words at the same time in

the relationship “or”. There were 3378 papers to be found. To select a theme on industrial development, “industrial development” was set as the theme word to refine the results. Finally, 121 papers were selected. Some of the literature from the CNKI were the same as the core collection of WOS. This was because CNKI was connected to some similar English data such as Science direct, MDPI. These papers were read to obtain the results and conclusions on IID promoting TAL or IAHS conservation. Based on the information on Chinese practices, we summarized the existing routes of IID promoting TAL conservation and the mechanisms of coordinating the relationship among multiple stakeholders.

Considering many studies on IID promoting IAHS conservation in China were still unpublished, we actively attended academic conferences on agricultural cultural heritage in China, including the annual conference of national-level agricultural heritage, the agricultural heritage research forum, workshops of the Chinese Association of Agro-science Societies, and the forum on agricultural heritage of the Ecological Society of China. By taking part in these conferences, we obtained newly relevant information from the academic reports of scholars. For the case studies, we conducted field surveys in the Anxi Tieguanyin Tea Culture System seven times from April 2019 to November 2021, and in Longji Terraces five times from January 2018 to September 2020. The interviewees included officers of industrial departments of Anxi County and Longsheng County, relevant enterprises, cooperatives, and households. The survey methods include semi-structured interviews and second-hand collections. The interview content includes industrial types and formed chains, organization modes of enterprises and cooperatives, the cooperation relationship and benefit distribution mechanism among different stakeholders. The second-hand materials include local people’s employment, economic benefit, operation conditions of enterprises and cooperatives, yields and prices of different agricultural products, and the operation and management institutions of companies and cooperatives. In addition, the prices of agricultural products, sales volume, and economic indicators in other IAHS sites in China were searched using e-shops or statistical yearbooks.

3. Routes and Mechanisms of Promoting IAHS Conservation

3.1. The Routes of IID Promoting IAHS Conservation

The IAHS definition originated from the GIAHS proposed by FAO. It was defined as “remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the coadaptation of a community with its environment and its needs and aspirations for sustainable development” [9]. At the same time, the GIAHS criteria were established by FAO. After modifying FAO several times, the five criteria of the GIAHS were defined as: important contribution to food and the livelihood security of local communities, globally important agrobiodiversity, local and traditional knowledge systems, ingenious culture, value systems and social organizations, and outstanding and slowly evolving landscape and seascape features; a traditional agricultural system can be designated as GIAHS with only five prominent features [26]. It is apparent that resources in IAHS sites have ecological, health, indigenous, ingenious and unique features. As a brand for commercial marketing, the “IAHS” gives those products from IAHS sites a meaning of high-quality; it is thus feasible to enhance value per unit area by increasing the product price. Moreover, the IAHS is a compound system which refers to agro-products, landscapes, wild organisms, eco-environment and agricultures [13]. As a result, the primary, secondary, and tertiary industries can be developed depending on the resource system of IAHS. Correspondingly, local farmers can obtain a higher income by carrying out non-farm jobs in their hometown.

3.1.1. Increasing Product Price through IAHS Branding

The word “Brand” comes from the Old Norse word “Brandr”, which means to give a strong and stable impression for distinguishing one thing from something else [28]. A brand can bring a premium to its holders or increase the value of goods, which is an intangible asset. It is a compound of names, attributes, symbols, or designs. Its value-

added function comes from the impression in the consumer's mind. In this way, branding the IAHS is an effective approach to increase a product's price. In the past two decades, multiple stakeholders; for example, enterprises and local governments in IAHS sites and MARA, have been implementing this work through various forms and media. In order to boost IAHS popularity, a significant amount of relevant news and TV programs about their cultural, ecological, and social significance have been reported by different channels on China Central Television, provincial and lower-level Television, as well as network media [29–31]. Second, in IAHS sites, a series of scientific investigations into IAHS sustainability, the nutritive value of agricultural products and the assessment of farmland environment quality and socio-cultural value were conducted to testify to the advantages of GIAHS products [32–34]; these conferences allowed consumers to better understand GIAHS and the products at these sites [35]. Third, many GIAHS sites designed an individual LOGO to be adopted as a brand symbol for their products produced at the GIAHS site; for instance, the Qingtian Rice-fish Culture, Huzhou Mulberry-dyke and Fish Pond System in Zhejiang Province, Aohan Dryland Farming System in the Inner Mongolia Autonomous Region, and Xiajin Yellow River Old Course Ancient Mulberry Grove System in Shandong Province. Fourth, ensuring that agricultural products from IAHS sites are certified as organic or green is also a common method used by enterprises and managers at IAHS sites to enhance the reputation of these products [36]. In addition, the MARA have held annual promotional activities for GIAHS products, called as “农遗良品 (good products from IAHS sites)” since 2019 to improve the reputation of the IAHS brand.

The IAHS brand has had a significantly positive effect on increasing the price of agricultural products and the processed products based on them. As shown in Table 1, for example, the rice with shell produced in the rice–fish coculture system in Qingtian, the first GIAHS site in China, were sold at the price of 4.4 yuan/kg, which was 16% higher than the same rice produced outside the GIAHS site. The fragrant glutinous rice from Dong's Rice-Fish-Duck System in Guizhou Province was 25.6 yuan/kg, which was 28% higher than the glutinous rice near the GIAHS site. Likewise, the red rice from Hani Rice Terrace System was 1.6 times as much as other general red rice in price. Furthermore, other agricultural products were also higher than those produced according to conventional methods. Fish bred in a rice paddy in Qingtian were sold at the price of 120–160 yuan/kg, 1.7–2.3 times that of the same kind of fish bred in ponds. Overall, owing to wide publicity, the IAHS brand greatly benefits farmers in IAHS sites, driving them to protect IAHS.

Table 1. Price of the rice with GIAHS brand in different GIAHS sites in 2022.

Agricultural Product	From GIAHS Site (Yuan/kg)	From the Places Near the GIAHS Site (Yuan/kg)	
Rice with shell	Qingtian Rice–fish culture	4.4	3.8
Live fish	Qingtian Rice–fish culture	120–160	70
Fragrant glutinous rice	Dong's Rice–Fish–Duck system	25.6	20
Red rice	Hani Rice Terrace System	25	15

3.1.2. Diversifying Farmers' Incomes by Developing Resources in IAHS Sites

The IAHS includes an agricultural production system, landscapes and a socio-cultural system. As a result, different kinds of resources can be used to develop different industries for diversifying farmers' income sources. IN IAHS sites, the agricultural production system provides diverse planting and breeding. Unlike modern agriculture, characterized by mono and large-scale crop planting, it can produce various agricultural products rather than just one. Thus, farmers earn agricultural income from many different crops. For example, the Rice–Fish–Duck System and Rice–Fish coculture system provide more than two kinds of main products for farmers. Many forestry systems: for instance, the Chinese ancient jujube garden, include not only fruit trees but also vegetables, millet, and other crops under the fruit trees [37]. Therefore, the income per unit area is enhanced. It was reported that the

benefit of rice–fish coculture per hectare in Qingtian increased by around 10 times more than that of conventional monoculture rice due to higher product prices resulting from the GIAHS brand and more diverse products such as fish, other than rice [38].

As a result of the success of landscapes, culture, and agricultural production at IAHS sites, many non-agricultural industries have also been developed such as tourism, product processing and manufacture, and other relevant services [25,39]. Farmers, as the owners or maintainers, participate in these non-agricultural industries to obtain further income in addition to their agricultural work. For example, farmers in the GIAHS Zhagana Agriculture–Forestry–Animal Husbandry Composite System in the Qinghai-Tibet Plateau obtained more money from tourism based on the rape flower landscape by operating tourist services such as restaurants and hotels [39]. In some villages of Longjing Terraces, farmers received over 70% of their income from local non-farm jobs, including marketing, working in the hotels or operating their own restaurants/hotels or transportation [25].

IAHS conservation is an important task for local governments once a traditional agricultural system is designated by FAO as GIAHS, or by MARA as China-NIAHS. In order to encourage farmers in IAHS sites to grow crops according to traditional ecological production methods, compensation policies are usually made by local governments; for example, ecological compensation for organic production, compensation for cultural conservation or reclamation of abandoned farmland [40,41]. According to our survey, all the GIAHS sites in China have introduced different kinds of compensation policies for landscapes, traditional knowledge and technologies, or agroecosystem conservation. For example, the Fuzhou jasmine and tea culture system provide the subsidy of 3000 yuan/mu (mu is a Chinese area unit, 1 mu \approx 0.067 ha) for farmers who grow jasmine with more than 5 mu (\approx 0.333 ha) (Table 2). In sum, diversifying income-increasing approaches can drive farmers to actively farm to maintain the agroecosystem and socio-cultural stability of IAHS.

Table 2. Compensation Policies in Different GIAHS Sites.

GIAHS Sites	Compensation Item	Compensation Standard
Fuzhou jasmine and tea culture system	The new plant jasmine base with more than 5 mu (0.333 ha)	3000 yuan/mu
Dong’s Rice–Fish–Duck system Youxi Lianhe Terraces	The Rice–Fish–Duck demonstration model The reclamation of abandoned farmland	Fry 2 kg/mu 800 yuan/mu
Anxi Tieguan Yin Tea Culture System	Returning the tea garden where is suitable to plant tea trees to forestry	2000 yuan/mu

3.1.3. Employing More Seasonal Surplus Laborers through Extending Industrial Chains

With the improvement agricultural productivity, it is inevitable that surplus labor appears in rural areas when the original industrial structure does not change. Therefore, part of the labor force in rural areas are bound to flow into urban areas for employment, resulting in rural population structure and socio-cultural change [42]. These changes impact traditional agricultural production mode and rural culture in IAHS sites. Keeping a certain number of farmers working in their hometown for a whole year is a necessary way to maintain IAHS. Hence, it is important that extending industrial chains based on the resources in IAHS sites provides employment opportunities for surplus laborers, especially for those seasonal ones.

For IAHS sites, with resource advantages including ecological or special agricultural products and landscapes, traditional cultural elements can be used to develop diverse secondary and tertiary industries [13]. Meanwhile, small-scale traditional agriculture requires a special means of production; for example, manufacture of organic fertilizers, farm tools and small machine manufacture. This supplies chances to develop upstream industries. In detail, as shown in Figure 2, tourist services can be developed based on IAHS landscapes; for example, catering, passenger transport, hotels, retailing, sightseeing and entertainment industry [43]. Agricultural products such as raw materials are used to develop processing and manufacturing industries [44]. According to the requirement of

traditional agricultural production, processing industries for production materials need to be built [13]. Regarding traditional culture in IAHS sites, cultural and creative industries, such as, film and TV production, drawing, product design and handicraft production, can be developed [44]. Furthermore, industries including telecom, logistics, technology, commercial and information services also need to be developed to serve product marketing, circulation, and other industries mentioned above. Eventually, the products are sold to tourists who visit IAHS sites or external markets through commercial services, logistics and so forth.

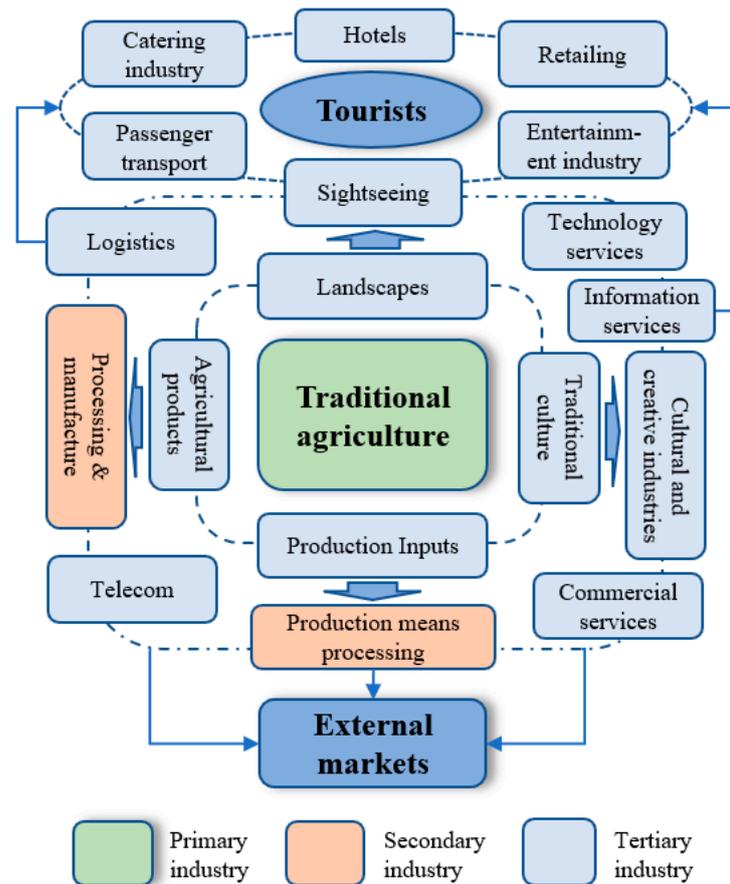


Figure 2. Industrial system in IAHS sites.

Overall, making a feasible IID strategy is necessary in IAHS sites. Diversifying industries based on traditional agriculture is a sustainable measure to effectively protect IAHS.

3.2. The Mechanisms of Coordinating Relationship among Multiple Stakeholders in IID

Industrial sustainable development requires factors input, including enough funds, management, land, technologies, etc. Therefore, successful industrial development needs different stakeholders participate in every industry [45]. At the same time, finding an effective method to deal with the relationship among these stakeholders and encourage them to form strong relationships in IID is also important [12]. Hence, the key elements of multi-stakeholder involvement in an industry, including which stakeholders are involved, what industrial organization modes can be adopted, and what benefit distribution mechanism exists among them, needs to be clarified (Figure 3).

3.2.1. Stakeholder Types

For IID in IAHS sites, various stakeholders' involvement is very important; TAL cover a large amount of farmland and therefore benefit many people and industries. Concerning TAL conservation, farmers in IAHS sites are the most important stakeholders

as the direct maintainers of TAL. Whether they are willing to farm according to traditional methods depends on the conservation effect of TAL. Local communities are the basic social organization and play an important role in coordinating the beneficial relationships between farmers and other stakeholders to promote their cooperation. The governments at different levels are managers and supervisors of IAHS conservation; they supervise the IAHS conservation situation and introduce related policies to promote the IAHS conservation, including conservation regulations, incentive and punishment policies, and industrial preference policies [46]. Enterprises are the most important operators of industries as they have significant funds, high-efficiency management ability, and considerable insight into market changes. For IAHS sites, the success of IID cannot lack the participation of enterprises. In China, cooperative as a kind of new agricultural operator has become a type of important market entity, which organizes small farmers into a bigger production entity to enhance their game power in market trade to increase their benefits. Available practices in China have proved that each of these stakeholders play indispensable roles in IAHS conservation [12].

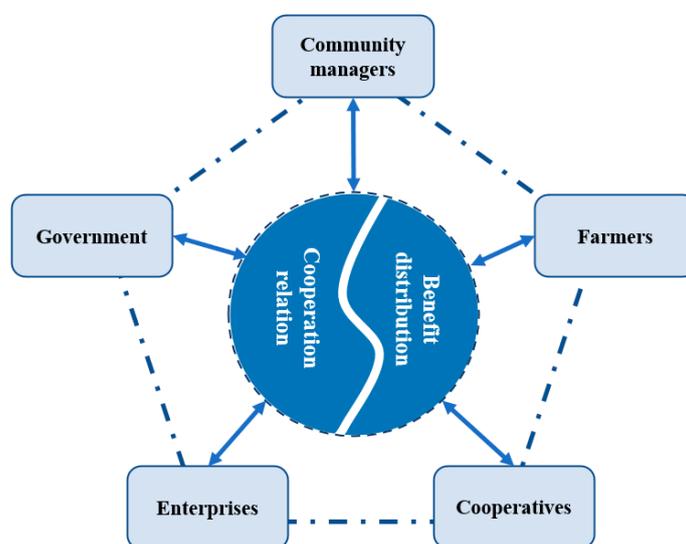


Figure 3. Relationship among multiple stakeholders in IID.

3.2.2. Industrial Organization Modes

In IAHS sites, one intention of industrial development is to employ surplus agricultural laborers; farmers are thus the key stakeholders involved in industries. The industrial organization mode influences farmers' benefits and then their willingness to participate in industries. At present, there are three main roles farmers play in industrial development: (1) farmers are simply traders who freely sell their products and services, or an employee taking part in the secondary or tertiary industry; (2) farmers sell or rent out their resources such as the use right of land and cultural carriers, as well as agricultural products, and set up a stable cooperation with other market entities by contracting enterprises or joining into cooperatives [12,25]; and (3) taking their assets as shares, farmers cooperate with enterprises to commonly operate an industry and earn a certain proportion of profit [12,25]. Each IAHS site usually coexist with several different types of industries, but their main industrial organization mode is at the agricultural and developmental level. Each IAHS site has its own industrial organization mode.

3.2.3. Benefit Distribution Mechanism

Whether stakeholders can continue to cooperate with each other depends on whether the benefit distribution mechanisms satisfy each party. Ensuring farmers' benefit is crucial to encourage farmers to maintain TAL. The benefit distribution scheme in an industry that relies on the industrial organization mode. As a result, the benefit distribution method

can be divided into three types: (1) Farmers obtain their earning based on the average market price of products or services, which is usually conducted under the free transaction; (2) The wage farmers earn by cooperating with other stakeholders is higher than by their own randomly free transaction, which includes mean profit and an extra income that cooperators transfer to them; this condition happens in the context of long-term and friendly cooperation between farmers and enterprises or cooperatives [47]; (3) Farmers earn their income not only through sales of their products, services, or labor, but also dividend based on their shares [25]. In practice, the three types exist in each IAHS site at the same time. Which type is more effective to TAL conservation is determined by different factors such as industrial type and development stage, features of the agricultural system, and benefit game.

4. Case Studies

4.1. Case 1: Anxi Tieguanyin Tea Culture System

The Anxi Tieguanyin Tea Culture System (ATTCS) in Fujian Province consists of Tieguanyin Tea production, the creation of tea making techniques, native tea tree varieties, rich folk history of tea cultivation, and the contribution of people to the tea landscape. Both the Tieguanyin tea making technique and the Tieguanyin tree variety originated in Anxi County (Figure 4). It was thus designated by MARA of PRC as China-NIAHS in 2014 and designated as GIAHS in May 2022. The traditional terraced tea garden is the most important element of ATTCS, which is a carrier of tea planting and those intangible elements such as traditional agricultural planting technologies, tea making techniques, and tea cultures [48]. The conservation of the traditional terraced tea garden landscape depends on the tea production activities conducted continually by tea farmers according to traditional methods.

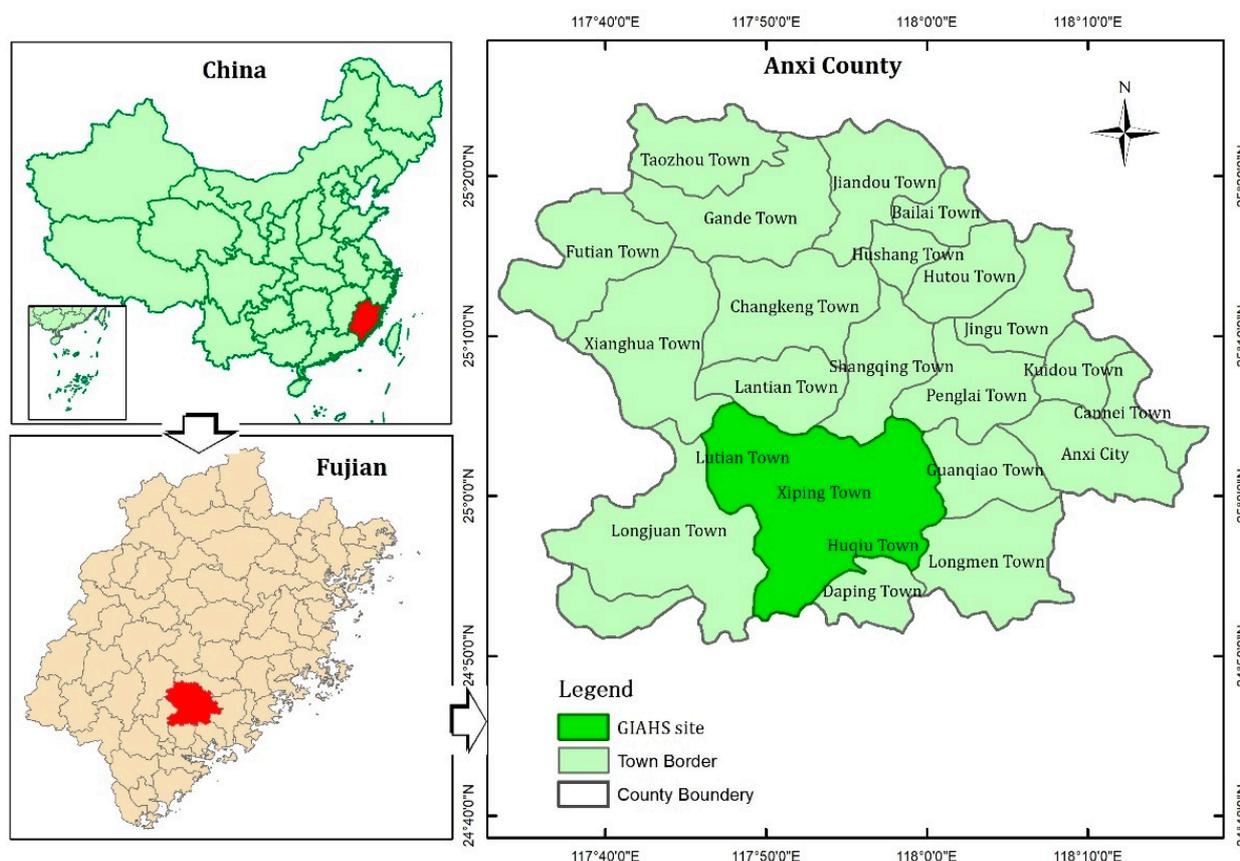


Figure 4. Location of Anxi County and scope of the GIAHS sites.

However, under the background of urbanization, ATTCS has already undergone area reduction in the traditional tea gardens due to abandonment resulting from population out-migration and the expansion of the tea garden based on chemical fertilizer-monoculture [49]. Later, a series of industries were developed around the IAHS to absorb local surplus laborers and enhance tea farmers' income through diverse approaches [50]. At present, at the ATTCS site, a complex industrial chain around tea has been built. As shown in Figure 5, centering on the traditional tea garden, four industrial systems have been developed. The industrial system referring to most farmers is tea processing and the related services, which covers tea raw processing (fresh tea leaves are made into Oolong tea with petiole), raw tea trade (raw tea is purchased from farmers and sold to the tea enterprises for tea refinement processing), tea refinement processing (raw tea is processed and packaged as a finished commodity), tea package production, and finished tea commodity marketing. The deep processing and manufacture of tea denotes those industries that process or manufacture the products based on tea as one of raw materials, which include the manufacture of tea beverage, tea food, and tea chemical products at the ATTCS site. The industrial system of education and research on tea culture mainly contains the industries of tea cultural education and technical training and tea cultural research; for example, tea vocational schools, tea training institutes. Tourism in this area consists of the tea garden sightseeing, tea cultural experiences, rural hotels and homestays, and catering (Figure 6).

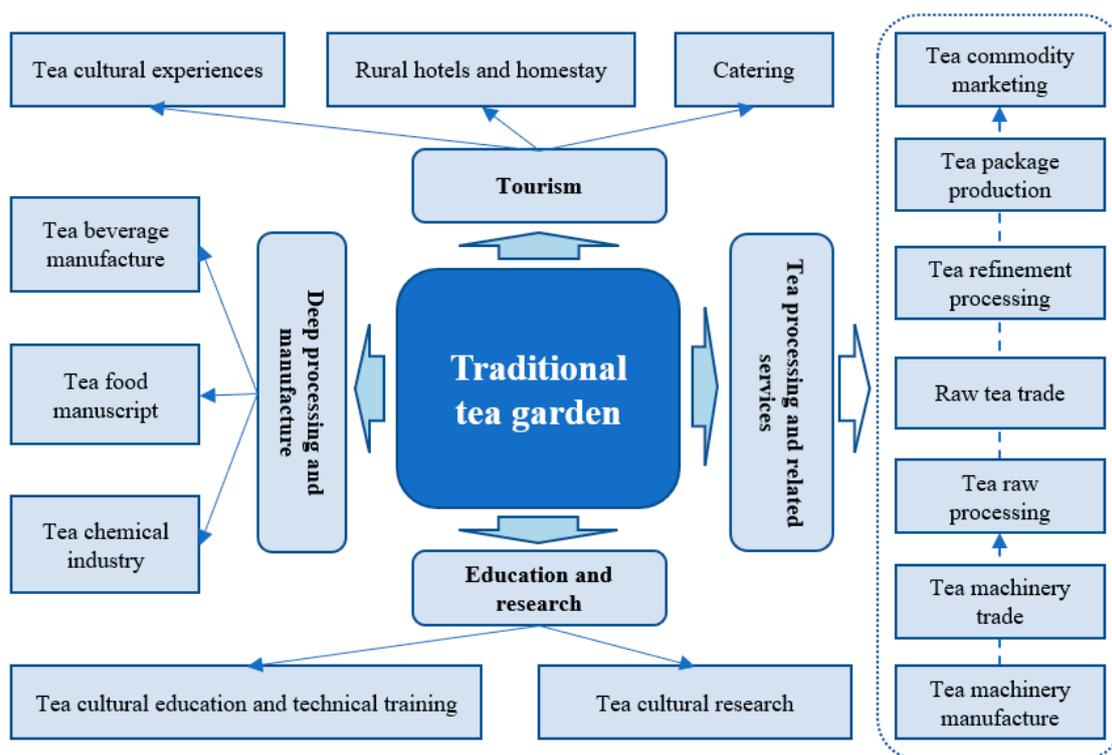


Figure 5. The industrial Chain of Anxi Tieguanyin Tea Culture System.

These industries directly or indirectly relate to tea, allowing Anxi county to transform from a national-level poverty county to one of the 100 richest counties in China. This site has also created many employment opportunities. It has been estimated that more 900 thousand people worked in tea related industries in 2021 in Anxi County. Tea planting is the main livelihood source for tea farmers, accounting for about 56% of their incomes in recent years according to the Anxi statistical yearbook 2021. For the farmers in the core area of the ATTCS site in particular, this proportion was over 70% according to our field surveys. With the implementation of the GIAHS conservation project, high-value ecological and cultural industries concerning tea began to appear. As a result, farmers'

income was more diverse, being derived from non-agricultural jobs, assets income and ecological compensation, in addition to agricultural production [50]. The IAHS brand has slowly become a powerful incentive for local farmers to protect TAL [51].



Figure 6. Landscape of Tieguan Yin tea garden.

In the ATTCS site, IID is close to multi-stakeholder involvement; enterprises and cooperatives played a key role in increasing tea farmers' income. Due to the frequent publicity and advertisements conducted by these stakeholders, Anxi Tieguan Yin has become a popular brand. Thanks to their cooperation with farmers, farmers have gained a stable sales channel and are able to maintain their higher and sustainable tea income even with fierce market competition. According to the statistics of Anxi County, the number of tea cooperatives increased from 3 in 2007 to 1607 in 2020 (Figure 7). The number tea enterprises were over 550 in 2012, increasing to over 650 in 2020. The main organization modes include “company + tea planting base + household”, “company + tea cooperatives + household”, “cooperatives + household” and “cooperatives union + tea cooperatives + household”. Enterprises or cooperatives encouraged poorer households to plant tea trees and bought their tea at a 15–20% above the market price. Furthermore, farmers obtain a salary from the enterprises or cooperatives by working on making tea or other non-farm jobs. In sum, these organization modes and benefit distribution mechanisms provided a win-win situation for farmers and other stakeholders, encouraging farmers to actively protect the TAL by continually planting tea.

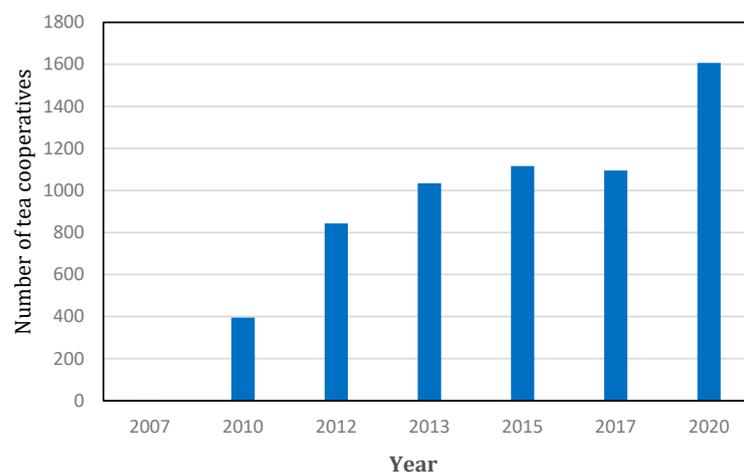


Figure 7. Number change of tea cooperatives in Anxi County.

4.2. Case 2: Longji Terrace, a Part of the Rice Terraces of Southern Mountainous and Hilly Areas

Longji terraces, located in Guilin prefecture, Guanxi, as a part of the Rice Terraces in Southern Mountainous and Hilly Areas, was designated by MARA of PRC as China-NIAHS in 2014 and by FAO as GIAHS in May 2018. It is a rice culture system that is more than 2000 years old (Figure 8) [48]. This IAHS includes a beautiful, terraced landscape, affluent crop varieties and livestock breeds (e.g., the geographical indication products, Feng Chicken and Cui Duck), traditional rice planting technologies and traditional farming culture [48]. The traditional rice terraces are the core element of this IAHS, which carry the rice planting activities and those intangible elements such as traditional agricultural technologies and rice cultures. As rice planting is too hard and offers a lower economic benefit, Longji terraces once faced threats such as the replacement of paddies with dry land or abandonment [52].

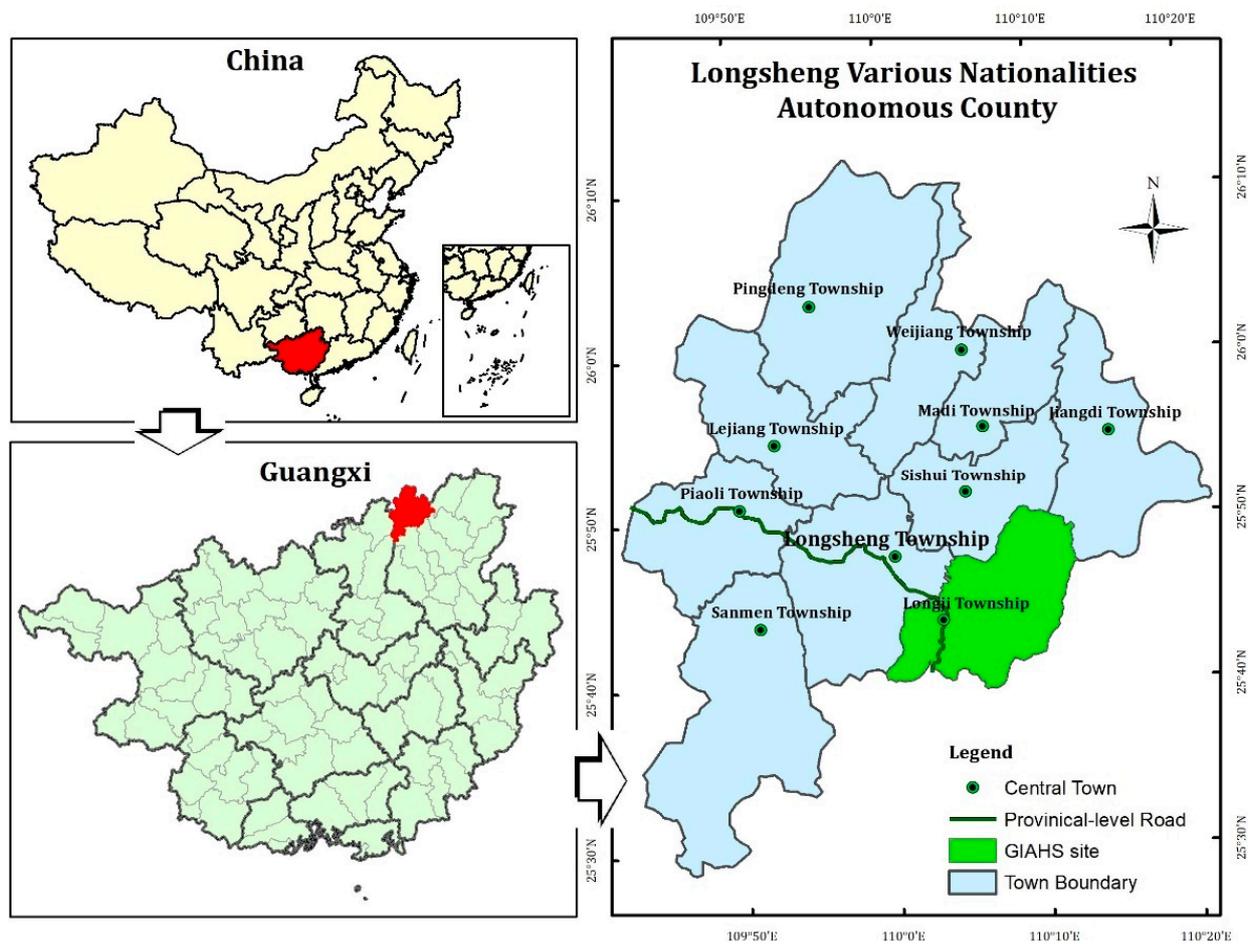


Figure 8. Location of Longji Terraces and scope of the GIAHS site.

With the rise in rural tourism, Longji Terraces were concerned due to their beautiful landscape and ethnic minority culture. Since 1990s, four villages in Longji Terraces were developed as tourist attractions [12]. The local county government, enterprises, leaders of these villages and farmers all participated in building the tourist attraction [12,25]. Now, an industrial chain of tourism around the terraced landscape has formed, which involves Rice–Fish coculture, terraced sightseeing, cable car sightseeing, passenger transportation, logistics, folk culture experiences, retailing, hotels and homestays, catering, and carrying services (local farmers provide the service carrying luggage to the hotels or homestays in the middle or on the top of terraces) (Figure 9).

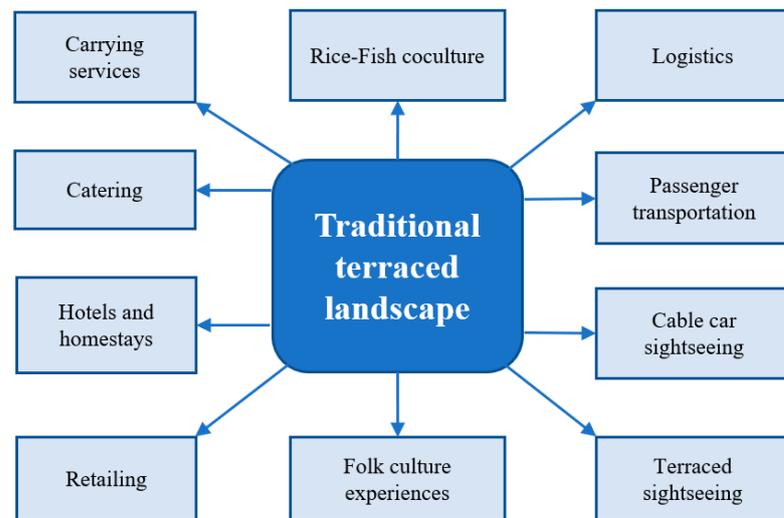


Figure 9. The industrial Chain of Longji Terraces.

All these industries are related to the rice terraced landscape (Figure 10). The farmers in the tourist attraction were involved in all these industries. For example, cable car sightseeing, terraced sightseeing, and passenger transportation were operated by three enterprises, respectively. The farmers shared the 4–7% ticket income that these enterprises charged, as they transferred part of their land use right and maintained terraced landscapes by farming [12,25]. Furthermore, local farmers directly operated the hotels/homestays, retailing shops, restaurants, or rented their homestead/houses to other people. Some farmers were employed in those hotels and restaurants, carried luggage for tourists, or took part in the performance of ethnic cultural programs. Through these pathways, they received a non-agricultural income far higher than the agricultural income. According to surveys, the non-agricultural income of poorer households in Dazhai village, an administrative village, was more than 10 times that of agricultural production income [25]. Therefore, IID in Longji Terraces effectively promotes terraced landscape conservation.



Figure 10. Landscape of Longji terraces.

In Longji Terraces, the benefit distribution mechanism played an extremely crucial role in the IID. The leaders of the villages coordinated the relationship among farmers in each village to reach an agreement on resources development. As the farmers' deputy, they

actively sought cooperators to cooperatively develop the terraced landscapes and introduced a sustainable dynamic benefit distribution scheme to achieve results that benefitted multiple stakeholders. For example, depending on the number of tourists in the villages, tourism enterprises are required to pay a certain compensation to the farmers who plant rice in the terraces. If the number of tourists visiting the village is equal to or more than 360,000 a year, farmers would receive compensation of 15,000 yuan/ha. If the number is less than 360,000 a year, they would receive 7500 yuan/ha [12]. This dynamic compensation standard encouraged farmers to actively protect terraced landscapes, especially considering that their income would increase with benign tourism development.

5. Discussion

TAL as a form of sustainable agricultural production system shows how humans can coexist with the natural environment around them, usually by maintaining high species richness by using traditional ecological farming methods [53,54]. However, these landscapes have been disappearing due to the introduction of new crop varieties, the modernization of agronomical techniques, and the pursuit of economic benefit [55]. Thus, in recent years, interest in conserving these landscapes has increased, especially with the GIAHS initiative, and studies on TAL conservation also increased. IID promoting TAL conservation has been proposed and agreed consistently because the economic benefit is the most important driving force to change TAL [12,13,26,27,56]. However, a comprehensive summary is still short of providing an understanding of how IID promotes IAHS conservation based on the available literature. This study reviewed the available literature and conducted many field surveys to comprehensively analyze and summarize the functioning mechanism of IID prompting TAL conservation. Theoretical and case analyses both showed extending income-increasing routes for farmers in IID and building corresponding fair and effective coordinating mechanisms were very significant in driving farmers to continue to farm. On the premise of good heritage conservation, promoting IID is a sustainable way to IAHS sites.

Under the background of fierce global environment changes, the industrial development model is continuing to transform [57]. Selecting the right route is crucial to regional sustainable development. Developing high-quality industries; for example, ecological, green and cultural industries, is an orientation of upgrading rural industries and is also an advantage for IAHS sites due to their ecological and cultural advantage [13]. It also benefits TAL conservation because it meets the IAHS conservation criteria and can increase a product's price. Extending the industrial chain based on resources in IAHS sites can create more employment opportunities for local farmers. Farmers can carry out part-time non-farm jobs for extra income in their hometown in addition to agriculture [18,25]. This not only ensures there are enough farmers to maintain the TAL through agricultural production, but it also resolves the employment of seasonal surplus laborers in IAHS sites in order to maintain a stable social structure and traditional cultural inheritance [25].

Identifying the key protection elements of IAHS and systematically analyzing the impacts of different industrial types on these elements' conservation is an extremely difficult task. There are many instances in which industrial development can destroy IAHS. For example, alien species introduced to plant or breed can destroy the original ecological imbalance, though they generate a high income for farmers. In Hani terraces, crayfishes were introduced, leading to the destruction of terraced ridges due to digging holes [58]. In some IAHS sites, tourism items not related to IAHS were developed and resulted in IAHS destruction [59]. Therefore, when selecting industries, whether the resources of IAHS will be industrial-based and whether those industries will benefit IAHS conservation needs to be fully considered.

The relationships among stakeholders and their identity are important factors that influence the effect of IID promoting IAHS conservation. A negative benefit distribution scheme in industrial development can drive stakeholders to damage IAHS. For example, in Ifugao terraces in the Philippines, tourism development hardly enhanced rice-terraced

landscape conservation because tourism companies obtained the most benefit, whereas the villagers did not. Eventually, farmers abandoned farmland or grew dry crops to damage the rice terrace landscape [60]. Whether enterprises and its leaders are local people or not also determines the effect of IID prompting IAHS conservation. Generally, the local people are better equipped to consider the sustainability of industries in an environment and the economic aspects, as well as the farmers' benefit. For example, in Anxi County, almost all the enterprises were held by local people; thus, these enterprises play an important role in IAHS conservation. Furthermore, introducing an effective benefit distribution principle is based on the repeated game among stakeholders. Finally, the principle is dynamic, and stakeholders can gain more income with the improvement of IID level, but this can decrease due to the depression of IID. This can encourage stakeholders to work hard according to the contract that they reach [12].

This study was conducted based on the available literature and our field surveys. There is no doubt that many issues regarding IID were not considered fully. For example, the use management of the IAHS brand is a significant problem. When the IAHS brand becomes a symbol with high value, its use and supervision will be confronted with difficulties, such as who can be granted to use this symbol and how can we prevent products from IAHS sites from being impacted by bogus products. Furthermore, in IID, governments at the different levels may also conflict with each other while making relevant policies due to considering the difference in scope of the beneficiaries. For example, the leaders of a town just consider their town's benefit, but the leaders of a county will consider the whole county when laying the industries out. They may have different opinions and these differences may negatively impact IAHS conservation. Overall, there are many relevant themes on IID and IAHS conservation that need to be more deeply researched.

6. Conclusions

TAL maintenance depends on agricultural activities carried out by farmers. Under the background of gradually decreasing economic benefit, promoting IID to enhance farmers' income is a way to protect TAL. In this study, IAHS as a typical TAL are taken as an example. Through the available literature review and field surveys, the pathways and coordinating mechanisms of IID promoting TAL conservation in IAHS sites were studied. The findings suggest that increasing product price through IAHS branding, diversifying farmers' income by developing special resources and employing more seasonal surplus labor by extending industrial chains are the main pathways of protecting IAHS on the basis of IID. Building a fair and reasonable benefit coordination mechanism among stakeholders plays a key role in achieving IID, prompting IAHS conservation. However, the introduction of an effective benefit coordination mechanism rests on accurately identifying key stakeholders of IAHS conservation, selecting industrial organization modes suitable to the IAHS, and introducing benefit distribution mechanisms that can prompt farmers to continue to farm. The two case studies also testify that diversifying farmers' income and ensuring an increase in their income with industrial development are the fundamental guarantee to protect IAHS. Furthermore, the advantage of IAHS resources and the win-win benefit distribution are two important principles of IID. In the future, stakeholder conflicts in IID and IAHS conservation and their resolutions will require more in-depth research to improve the effect of IAHS conservation.

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