Thoughts on the Inheritance and Development of Farming Culture of the Rice Whole Industry Chain in the Yangtze River Economic Belt

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Abstract The Yangtze River Economic Belt is the birthplace of the world's rice farming culture, and is the origin of common rice (*Oryza sativa* L.), wild rice (*Oryza Rufipogon* Griff.), medicinal rice (*Oryza officinalis* Wall. ex G. Watt), and wart-grain rice (*Oryza granate* Nees et Arn. ex Hook. f.). Rice culture is the main theme of agricultural culture in this economic belt and an outstanding representative of excellent traditional Chinese culture. This study provides an overview of the history of rice cultivation in the belt from the prehistory, post-history and modern progress. It studies the agricultural cultural heritage resources of the whole rice industry chain from the biological genetic resources, world cultural heritage, key cultural relics protection units, national archaeological site parks, movable cultural relics, important agricultural cultural heritage, intangible cultural heritage, China time-honored brands, historical names, traditional markers, tribute culture, archival and documentary heritage. It also analyzes the six main problems in the inheritance and development of rice farming culture, and proposes 8 strategies, including promoting the inheritance and innovative development of excellent traditional Chinese culture through the inheritance of rice farming culture, promoting the Exploration of the Origins of Chinese Civilization Project through rice farming culture, and creating the Yangtze River National Cultural Park with rice farming culture as the main theme.

Key words Yangtze River Economic Belt, Rice (*Oryza sativa* L.), Whole industry chain, Rice cultivation culture, Agricultural culture, Inheritance and development

0 Introduction

The Yangtze River Economic Belt[1-3] covers Shanghai, Jiangsu and Zhejiang in the eastern region, Anhui, Jiangxi, Hubei and Hunan in the central region, and Chongqing, Sichuan, Guizhou and Yunnan in the western region. The Yangtze River Economic Belt is an inland river economic belt with global influence and a coordinated development belt of interaction and cooperation between the East and the West of China. As the main functional production area of rice in China, the Yangtze River Economic Belt has 14.57 million ha of rice, accounting for 64.26% of the national rice area. In the past, some foreign scholars mistakenly believed that indica rice originated from India and japonica rice originated from Japan. However, many scholars in China mistakenly believe that China's rice culture originated in South China or the Yunnan - Guizhou Plateau. However, in recent years, archaeological and prehistoric studies on rice cultivation have confirmed that the middle and lower reaches of the Yangtze River (especially the upper reaches of the Xiangjiang River and the middle and lower reaches of the Lishui River, the Qiantang River Basin and the middle and lower reaches of the Huaihe River Basin in the Taihu Lake area, the Poyang Lake area and the Dongting Lake area) are the birthplaces of the world's rice farming culture[4-6], and also the origin of *O. sativa* (indica, japonica) and *Oryza rufipogon*. The south-central part of Yunnan Province is an origins of *Oryza officinalis* and *Oryza granulate*.

Rice farming culture refers to the culture with rice cultivation as the main mode of survival and development, including various customs related to clothing, food, housing and transportation derived from it, which is not only the main theme of farming culture in the Yangtze River Economic belt, but also an important part of Chinese excellent traditional culture[7-11]. According to the 14th *Five-Year Plan for the Inheritance and Development of Excellent Traditional Chinese Culture* issued by the Publicity Department of the Communist Party of China (CPC) Central Committee, 23 key projects have been identified, including the Chinese Cultural Resources Survey Project, the Agricultural Culture Inheritance and Protection Project, the Intangible Cultural Heritage Inheritance and Development Project, the Chinese Time-honored Brand Protection and Development Project, and the Chinese Traditional Village Protection Project, Chinese Traditional Festival Revitalization Project, National Ancient Book Protection and Digitization Project, and National Cultural Park Construction Project. The *Report of the* 20th *National Congress of the Communist Party of China* proposed to "promote cultural self-confidence and self-improvement, and create a new glory of socialist culture", and called for "increasing the protection of cultural relics and cultural heritage, strengthening the protection and inheritance of history and culture in urban and rural construction, and building and making good use of national cultural parks", "adhere to the position of Chinese culture, refine and display the spiritual identity and cultural es-

Received: November 28, 2024 Accepted: January 23, 2025
Supported by Social Science Foundation of Hubei Province (HBSKJJ20243227), Doctoral Initiation Project of Hubei University of Science and Technology (BK201819).
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sence of Chinese civilization", "adhere to promoting tourism through culture, promote the in-depth integration and development of culture and tourism", "enhance the communication power and influence of Chinese civilization", *etc.*

Project of Exploration of the Origins of Chinese Civilization, also known as the comprehensive study of the origin and early development of Chinese civilization, is based on archaeological investigation and excavation as the main means to obtain relevant information, supported by modern science and technology. It is a major scientific research project to reveal the origin and early development of the five thousand year civilization of the Chinese nation by means of interdisciplinary research. The project includes a large-scale archaeological survey of settlements around Liangzhu Site in Zhejiang Province and Shijiahe Site in Hubei Province, aiming at demonstrating the 5 000-year Chinese civilization in the Yangtze River Economic Belt, especially the rice farming civilization, with abundant archaeological data[7]. The Yangtze River National Cultural Park was officially launched on January 3, 2022, focusing on the construction of the main functional areas such as control and protection, theme display, integration of culture and tourism, and traditional utilization, and systematically promoting the construction of key infrastructure projects such as protection and inheritance, research and excavation, environmental support, integration of culture and tourism, and digital reproduction, with the aim of coordinating and promoting the protection, inheritance and utilization of cultural relics and cultural resources. In view of this, we analyzed the strategy of inheritance and development of rice farming culture in the Yangtze River Economic Belt from the whole rice industry chain.

1 Historical overview of rice cultivation

1.1 Prehistory The rice farming culture in the Yangtze River Economic Belt has a long prehistoric history, which has been fully proved by the archaeological discoveries of rice farming in the national key cultural relics protection units in Zhejiang, Jiangxi, Hunan and other provinces. These archaeological data reveal the status of the economic belt as the cradle of rice farming culture in the world[4-6]. In the Taihu Lake area, the Poyang Lake area, the upper reaches of the Xiangjiang River and the middle and lower reaches of the Lishui River in the Dongting Lake area, and the Qiantang River Basin and the middle and lower reaches of the Huaihe River Basin, the history of the ancestors planting indica and japonica rice can be traced back to 12 thousand years ago, and the history of collecting *O. rufipogon* can even be traced back to 24 thousand years ago.

Studies have shown that the Shangshan site in Pujiang County and the Hehuashan site in Longyou County, Zhejiang Province, reveal that the distribution of *O. rufipogon* in the middle and lower reaches of the Yangtze River can be traced back to 100 000 years ago (100 ka BP). *O. rufipogon* was collected as a food resource about 24 000 years ago (24 ka BP) and cultivated before domestication about 13 000 years ago (13 ka BP); the domestication of rice was realized 11 000 years ago (11 ka BP), which marked the origin of rice agriculture. The records of rice spikelets from the Tianluoshan site in Zhejiang Province further show that the ancestors of the lower reaches of the Yangtze River had begun to use wetlands to grow rice. With the passage of time, the proportion of domesticated rice in cultivated rice population gradually increased, the original wild characteristics gradually weakened, and the yield of rice also increased. The artificial cultivation of rice reached its peak between 6 900 and 6 600 years ago (6.9 to 6.6 ka BP). Studies on the phytolith and rice pollen of wild and cultivated rice from the Xianrendong and Diaotonghuan sites in Wannian County, Jiangxi Province, show that the ancestors in the middle and lower reaches of the Yangtze River mainly collected *O. rufipogon* and began to cultivate rice at 12 ka BP. The 12 ka BP carbonized rice was unearthed from the Yuchanyan site in Daoxian County, Hunan Province, and the earliest rice with artificial intervention traces was found in the middle reaches of the Yangtze River. At the Pengtoushan site in Lixian County, Hunan Province, about 8.5 ka BP potsherds were found with rice impressions, and rice pollen was recorded in the soil layer. About 8 584 grains of golden yellow rice with 7 or 8 ka BP were unearthed from the Baishidang site in Lixian County.

The rice farming culture in the middle and lower reaches of the Yangtze River then moved northward to the lower reaches of the Huaihe River in northern Jiangsu, such as the Hanjing site in Sihong County, at 8.5 ka BP. At 7 ka BP in Anhui, it spread to the middle reaches of the Huaihe River in northern Anhui, and converged with the original dry farming *Setaria italic* var. *germanica* (Mill.) Schred and *Panicum miliaceum* L. from the Yellow River Basin at the Shuangdun Site in Huaishang District, Bengbu City[12]. At 5 ka BP in Hubei Province, it crossed the Jianghan Plain, the wasteland of the lake at that time, to the Qujialing site in Jingshan City.

It was more difficult for the rice farming culture to travel westward, and it took 5 ka BP to cross the Three Gorges on Yangtze River, which made the ancestors in the eastern and western parts of the Yangtze Gorges in Chongqing change from fishing and hunting civilization to farming civilization. It was not until 4.5 ka BP that it reached the Chengdu Plain in Sichuan Province and converged with primitive dry farming such as *P. miliaceum*, which originated from the Yellow River Basin. The rice farming culture migrated to the Yunnan – Guizhou Plateau, entering Yunnan at 4.6 ka BP, and climbing to Zhongshui Town, Weining Autonomous County, Guizhou Province at 3 ka BP.

1.2 Post-history The literature records the history of rice farming culture in China (especially in the Yangtze River Economic Zone). In the Western Zhou Dynasty, agriculture was emphasized, agricultural production technology was improved, and rice production increased. Agricultural tools are made of various materials, including stone, bone, clam, wood, pottery, bronze

and so on. In the period in Spring and Autumn, agriculture was further developed, farm tools were ironized, and the farming technology model of intensive cultivation was gradually improved. In the period of Warring States, rice cultivation in the Yangtze River Basin is developed, and a large amount of japonica rice is preserved in the granary of Xingan County, Jiangxi Province, with an area of about 600 m^2. In the Western Han Dynasty, the Replacement-Field Method and Pit Field Method appeared and were popularized. Rice is not only the main food crop in the Yangtze River Basin, but also its planting area is expanding rapidly. Rice varieties are abundant, including indica rice, japonica rice, sticky rice, glutinous rice and other varieties. Then, rice spread to Iran and Japan.

The *Records of the Grand History of China Biography of Rich Merchants* recorded the farming method of "vast land and sparse population, eating rice and fish, or fire ploughing and water weeding" in the south of the Yangtze River. In the Eastern Han Dynasty, ploughing and oxen ploughing developed to an unprecedented height, and oxen ploughing methods were divided into a yoke of two cattle for tilling and one-cattle plough. In *Monthly Instructions for the Four-People* written by Cui Shi in the Eastern Han Dynasty, it has been pointed out that the appropriate density of "rice, fertile fields should be thin, while barren fields should be dense". The mode of fish farming in paddy fields has emerged. In the Western Jin Dynasty, Zhang Hua pointed out in his book *Records of the Investigations of Things* that "five soils are suitable, yellow and white are suitable for planting cereal crops, water field is suitable for rice, and if it is suitable, it will benefit a hundred times. In the south, Chinese trumpet creeper was planted as green manure in paddy fields. In the Western Jin Dynasty, Guo Yigong's book *Great Records of Things* stated that Chinese trumpet creeper spread and flourished, and could beautify fields. During the Northern and Southern Dynasties, the paddy field harrow was invented, and the intensive cultivation mode of "ploughing-harrowing-ploughing" was formed in the southern paddy fields. In the Northern Wei Dynasty, Jia Sixie recorded the drying field technique in his *Important Means of Subsistence for Common People*, as well as the paddy field rotation system of "rice has no affinity, but has to be replaced every year".

In the Tang Dynasty, plough with an incurved shaft appeared, compared with that with a straight shaft, it not only adjusted the depth of cultivated land, but also saved labor, could be lifted by an ox, improved the efficiency of farming, and accelerated the development of paddy fields in the south of the Yangtze River. Great poet Du Fu described in his poem that only when there is enough water can seedlings grow vigorously. During the Northern Song Dynasty, the seedling horse stool was invented to assist in transplanting rice seedlings. When great poet Su Shi passed through Wuchang, he saw local farmers using the seedling horse stool, and wrote the *Song for the Seedling Horse Stool*. The total output of rice jumped to the top of the five cereals. Lu You, a great poet of the Southern Song Dynasty, wrote in a poem that "the autumn wind stopped nine thousand hectares" and "the sound of rice harvesting in every family's field", from which we can see the large scale of rice planting at that time.

The double cropping system of rice and wheat has been popularized in the south of China, which has improved the land productivity in the south of the Yangtze River. Song Yingxing's *Exploitation of the Works of Nature* in the Ming Dynasty recorded that: "today, rice accounts for 70% of the people's food." This shows that the rice yield in the Ming Dynasty has accounted for about 70% of the total grain yield in the country. Emperor Kangxi of the Qing Dynasty successfully bred "imperial rice" and popularized its cultivation throughout the country.

1.3 Progress in modern period Modern rice cultivation takes high technology as its core productivity. From 1926 to 1933, Professor Ding Ying, the father of rice science in China, successfully bred "Zhongshan No. 1" by crossing common *O. rufipogon* with cultivated rice; in 1957, he divided rice into indica and japonica subspecies according to their morphological, physiological and ecological characteristics, and divided rice in China into six ecological zones according to ecology. Specifically, Jiangsu, Shanghai, Zhejiang, central and southern parts of Anhui (south of the Huaihe River), Jiangxi, Hunan (except the west), Hubei, Chongqing and Sichuan (except Ganzi Xizangan Autonomous Prefecture) in the Yangtze River Economic Belt belong to the single and double cropping rice zone in Central China, and the north of the Huaihe River in Anhui belongs to the single cropping rice zone in North China; the western part of Hunan Province, most of Guizhou Province, the central and northern part of Yunnan Province and Ganzi Tibetan Autonomous Prefecture of Sichuan Province are located in the southwest single and double cropping rice zone, and the southern part of Yunnan Province belongs to the double cropping rice zone of South China.

Professor Huang Yaoxiang, known as the "father of conventional rice in China", focused on the field of rice dwarf breeding and has successfully bred a series of semi-dwarf rice varieties. Professor Yuan Longping, known as the "father of hybrid rice in China", devoted himself to the in-depth research and wide promotion of hybrid rice technology. Based on the "wild abortive cytoplasmic" sterile line (WA-CMS), he invented the "three-line" indica hybrid rice with Professor Li Bihu, Professor Zhu Yingguo, Professor Xie Huaan and Professor Yan Longan. Professor Yuan Longping also worked with Professor Shi Mingsong and other experts to successfully develop "two-line" hybrid rice. This has jointly established China's super hybrid rice technology system with colleagues in the industry. Wild saline-alkali tolerant rice such as leek yellow rice and old yellow rice were found in the Taihu Lake Basin and other estuaries, and then the breeding and promotion of seawater rice (saline-alkali tolerant rice) were carried out, and the project of saline-alkali paddy field regulation was initiated.

Zhong Zhangmei, an agronomist known as the "father of bamboo rice", boldly carried out "distant hybridization between bamboo and rice" and successfully bred a new non-transgenic hybrid rice variety, bamboo rice, through artificial pollination technology. Bamboo rice not only has good quality and high yield, but also has the advantages of strong wind resistance and wide soil adaptability. Bamboo rice also has ecological functions such as improving soil, windbreak and sand fixation.

In 2002, *Science* published the "working framework map" paper and database of rice genome independently completed by Chinese scientists. In 2021, China recovered the allotetraploid *O. rufipogon* gene to provide support for the cultivation of better rice varieties. At present, the Yangtze River Economic Belt uses digital technology to realize the intellectualization of the whole process of rice "cultivation, planting, management and harvesting".

2 Cultural heritage resources of the whole rice industry chain

2.1 Biogenetic Resources Rice is an annual or perennial herb of the genus *Oryza* L. of the family Gramineae. There are about 24 species in the genus *Oryza* in the world, and there are mainly two cultivated species, one is *O. sativa* (also known as Asian cultivated rice) widely cultivated in the world, and the other is *Qryza glaberrima* Steud. (also known as African cultivated rice) mainly cultivated in tropical Africa. There are 6 species of genus *Oryza* in the Yangtze River Economic Belt, among which 4 species are protists: annual common rice (*O. sativa* L.) (there are individual perennial varieties); perennial wild rice (*O. rufipogon* Griff.), medicinal rice (*Oryza officinalis* Wall. Ex G. Watt), wart-grain rice (*Oryza granulate* Nees et Arn. Ex Hook. F.); two annual species were introduced: Qryza glaberrima (introduced in tropical areas such as southern Yunnan), broadleaf rice (Oryza latifolia Desv.).

O. sativa is divided into three subspecies: indica rice (also known as Indian type rice) *O. sativa* L. subsp. Indica Kato., japonica rice (also known as Japanese type rice) *O. sativa* subsp. Japonica Kato., and tropical type japonica rice (also known as javanica type rice) *O. sativa* subsp. Javanica. The middle and lower reaches of the Yangtze River Economic Zone are the origin of indica and japonica rice, and javanica type rice are introduced in tropical areas such as southern Yunnan. Indica rice is a heat-resistant short-day ecotype, which is mainly distributed in the tropics of the economic belt and the subtropical low-altitude areas south of Huaihe River and Qinling Mountains (less than 1.8 km above sea level). Japonica rice has the characteristics of drought tolerance, cold tolerance and weak light tolerance, and is mainly distributed in the higher altitude areas of the Yangtze River Economic Belt (more than 1.8 km above sea level) and the warm temperate zone north of the Huaihe River.

In the south and middle of Yunnan Province, there are rich biogenetic resources of wild rice *O. rufipogon* Griff., medicinal rice *Oryza officinalis* Wall. ex G. Watt, and wart-grain rice *Oryza granulate* Nees et Arn. ex Hook. f. There are abundant local variety resources of indica rice and japonica rice in the Yangtze River Economic Belt. According to China Seed Industry Big Data Platform, there are 8 384 rice varieties approved in the economic belt, including 204 in Shanghai, 695 in Jiangsu, 713 in Zhejiang, 1 169 in Anhui, 1 093 in Jiangxi, 953 in Hubei, 1 169 in Hunan, 437 in Chongqing, 764 in Sichuan, 340 in Guizhou and 847 in Yunnan; as many as 4 785 new varieties of rice agricultural plants were obtained, including 174 in Shanghai, 719 in Jiangsu, 466 in Zhejiang, 795 in Anhui, 282 in Jiangxi, 364 in Hubei, 1 115 in Hunan, 69 in Chongqing, 608 in Sichuan, 42 in Guizhou and 151 in Yunnan.

2.2 Immovable material cultural heritage

2.2.1 World Cultural Heritage. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has identified 44 world cultural heritages in China, among which the Hani terrace cultural landscape on the Red River and the ruins of Liangzhu Ancient City are closely related to the rice farming culture in the Yangtze River Economic Belt.

Honghe Hani Terrace Cultural Landscape, located in Honghe Prefecture, Yunnan Province, stretches across the four counties of Honghe, yuanyang, Luchun and Jinping on the south bank of Honghe River, extending continuously from the foot of the mountain to the high mountains (2 000 m above sea level), with a maximum of more than 3 700 levels, is a complete rice farming culture system that has experienced 1.3 Ka since the Sui Dynasty, and production of geographical indication Honghe red rice.

The ruins of Liangzhu Ancient City (about 3 300 – 2 300 BC), located in Yuhang District, Hangzhou City, Zhejiang Province, consists of four parts: Yaoshan Site Area, Gukou High Dam Area, Plain Low Dam-Mountain Front Long Embankment Area and City Site Area. It shows an early regional country supported by rice farming in the late Neolithic Age with unified beliefs, and is a holy place to prove the history of Chinese civilization and farming civilization for more than 5 000 years. Among them, 13 t of carbonized rice pools were found in a shallow pit on the eastern slope of Mojiao Mountain, and about 200 t of carbonized rice were found in the Zhongsi site, which was the site of the national rice reserve warehouse at that time. The water conservancy system outside the ancient city is the earliest large-scale water conservancy project known in China and the earliest dam in the world.

2.2.2 National key cultural relics protection units. (i) Prehistoric Remains. The remains of prehistoric rice farming culture in the Yangtze River Economic Belt mainly include grains and their impressions, rice stalks and their impressions, cobs, rice leaves, chaff, starch grains, rice fields, rice storehouses, rice phytoliths, rice sporopollen, *etc.*, which are mainly derived from 70 sites of national key cultural relics protection units in 9 provinces and cities. Among them, there are 2 sites in Shanghai: Songze Site in

Qingpu District (6 – 5 ka BP) and Guangfulin Site in Songjiang District (4 ka BP).

There are 14 sites in Jiangsu: Hanjing Site in Sihong County (8.5 – 7.5 ka BP), Shunshanji Site (8 ka BP), Dongshan Village Site in Zhangjiagang City (8 ka BP), Luotuodun Site in Yixing City (7 – 5 ka BP), Xixi Site (7 – 6 ka BP), Qingliangang Site, Huai'an District, Huai'an City (7 – 6 ka BP), Longqiuzhuang Site, Gaoyou County (7 – 5 ka BP), Sanxingcun Site, Jintan City (6.5 – 5.5 ka BP), Dadunzi Site, Pizhou City (6.5 – 4.0 ka BP), Xuecheng Site, Gaochun District, Nanjing City (6.3 – 5.5 ka BP), Qingdun Site in Haian City (6 – 5 ka BP), Caoxieshan Site in Wuzhong District of Suzhou City (6 ka BP), Chuodun Site in Kunshan City (6 ka BP), Tenghualuo Site in Lianyungang City (4.6 – 4.0 ka BP).

There are 13 sites in Zhejiang: Shangshan Site in Pujiang County (11 – 9 ka BP), Xiaohuangshan Site in Shengzhou City (9 ka BP), Kuahuqiao Site in Xiaoshan District, Hangzhou City (8 ka BP), Liangzhu Ancient City Site in Yuhang District (5.3 – 4.3 ka BP), Zishan Site (6.4 – 5.5 ka BP), Luojiajiao Site in Tongxiang City (7 ka BP), Tanjiawan Site (7 – 6 ka BP), Tianluoshan Site in Yuyao City (6.5 ka BP), Majiabang Site in Nanhu District of Jiaxing City (6 ka BP), Nanhebang Site (6 ka BP), Zhuangqiaofen Site in Pinghu City (5 ka BP), Caowanshan Site, Lucheng District, Wenzhou City (4.5 – 4.0 ka BP), Qianshanyang Site, Wuxing District, Huzhou City (4.4 – 4.2 ka BP).

There are 7 sites in Zhejiang: Gutai Temple Site, Yongqiao District, Suzhou City (8 ka BP), Shuangdun Site, Huaishang District, Bengbu City (7 ka BP), Yuhui Village Site, Yuhui District (4.4 – 4.1 ka BP), Xuejiagang Site, Qianshan County (6.0 – 3.5 ka BP), Lingjiatan Site, Hanshan County (5.6 – 5.3 ka BP), Yuchisi Site in Mengcheng County (5 ka BP) and Gaixia Site in Guzhen County (4.6 – 4.5 ka BP).

There are 4 sites in Jiangxi: Xianrendong and Diaotonghuan in Wannian County (12 – 9 ka BP), Shanbei in Xiushui County (5 ka BP), Guodishan in Yihuang County (4.8 ka BP), and Sheshantou in Guangfeng County (4.5 – 3.5 ka BP).

There are 10 sites in Hubei: Guanmiaoshan Site in Zhijiang City (6 – 5 ka BP), Diaolongbei Site in Zaoyang City (6.3 – 4.8 ka BP), Shijiahe Site in Tianmen City (6 – 4 ka BP), Zoumaling Site in Shishou City (5.3 – 3.9 ka BP), Yejiamiao Site, Xiaonan District, Xiaogan City (5.5 – 5.0 ka BP), Miaotaizi Site, Zengdu District, Suizhou City (5.5 – 3.0 ka BP), Qujialing Site, Jingshan City (5.3 – 4.6 ka BP), Chenghe Site, Shayang County (5 ka BP), Menbanwan Site, Yingcheng City (5 ka BP), Yinxiangcheng Site, Jingzhou District, Jingzhou City (4.9 – 4.7 ka BP).

There are 12 sites in Hunan: Yuchanyan Site (12 – 8 ka BP) in Daoxian County, Pengtoushan Site (9 ka BP) in Lixian County, Baishidang Site (8.0 – 7.5 ka BP), Shanlonggang Site (8 ka BP), Chengtoushan Site (6.5 – 4.2 ka BP), Sanyuangong Site (6.3 – 4.6 ka BP), Jijiaocheng Site (5.3 – 4.0 ka BP, Shanlonggang Site in Linli County (9 – 8 ka BP), Gaomiao Site in Hongjiang City (7.8 – 6.6 ka BP), Tangjiagang Site in Anxiang County (7.0 – 6.8 ka BP), Malanzui Site in Hanshou County (6.5 – 5.6 ka BP), and Chegushan Site in Huarong County (5.5 – 3.6 ka BP).

There are 3 sites in Sichuan: Sanxingdui Site in Guanghan City (4.5 ka BP), Gaoshan Ancient City Site in Dayi County (4.5 – 4.0 ka BP), Baodun Ancient City Site in Xinjin County (Baodun Site) (4.5 – 3.7 ka BP).

There are 5 sites in Yunnan: Haimenkou Site in Jianchuan County (5.3 – 2.8 ka BP), Baiyangcun Site in Binchuan County (4.6 – 3.7 ka BP), Shifodong Site in Gengma Autonomous County (4.0 – 3.8 ka BP), Shizhaishan Ancient Tomb Group and Site in Jinning District of Kunming City (4 ka BP to Eastern Han Dynasty), Dadunzi Site in yuanmou County (4 ka BP).

(ii) Post-historical remains. The rice farming culture remains in the Yangtze River Economic Zone, in addition to the same type in prehistory, also include rice farming tools, wine workshop sites, bamboo slips records, rice farming landscapes, hybrid rice memorial gardens, *etc.* There are 23 national key cultural relics protection units in 9 provinces. Among them, there are 3 sites in Jiangsu: the Granary Site of Song and Yuan Dynasties in Jingkou District of Zhenjiang City (from Song to Yuan Dynasty), the Haiyuncang Site in Taicang City (Yuan Dynasty), and the Xinghua Duotian Site in Xinghua City (since Song Dynasty); 2 sites in Zhejiang: Yongfengku Site, Haishu District, Ningbo City (Song to Ming Dynasty), Cangqian Granary Site, Yuhang District, Hangzhou City (Qing Dynasty); 2 sites in Anhui: Taijiasi Site (Shang and Zhou Dynasties) and Anfengtang (Shaopi) (Spring and Autumn Period) in Funan County; 2 sites in Jiangxi: Jiebu Granary Site (Warring States Period), Lidu Liquor Workshop Site in Jinxian County (Yuan to Qing Dynasty); 4 sites in Hubei: Panlongcheng Site in Huangpi District of Wuhan City (Shang Dynasty), Maojiazui Site in Qichun County (Western Zhou Dynasty), Dafengcang in Yunxian County (Qing Dynasty), and the site of cultural celebrities in Xiangyang Lake (modern times); 3 sites in Hunan: Liye Daban Site and Tomb Group in Longshan County (Han Dynasty), Laosicheng Site in Yongshun County (Ming to Qing Dynasty), Hybrid Rice Memorial Garden in Anjiang Agricultural School in Hongjiang City (modern times); 4 sites in Sichuan: Jinsha Site in Qingyang District of Chengdu (from Shang Dynasty to Western Zhou Dynasty), Shuijingjie Distillery Site (from Ming Dynasty to Qing Dynasty), Jiannanchun Distillery Site (Qing Dynasty), Wuliangye Laojiaochi Site (from Ming Dynasty to the Republic of China); one site in Guizhou: Ninggu Site, Xixiu District, Anshun City (Han Dynasty); 2 sites in Yunnan: Hebosuo Site, Jinning District, Kunming City (Warring States Period to Han Dynasty), Honghe Hani Terrace, Honghe Prefecture (since Sui Dynasty).

2.2.3 Provincial cultural relics protection units. The relics of prehistoric rice farming culture in the Yangtze River Economic Belt mainly involve 30 provincial-level cultural relics protection

units in 6 provinces and cities. Among them, there are 8 sites in Jiangsu: Pengzudun Site in Xishan District of Wuxi City (7 – 6 ka BP), Erjian Village Site in Haizhou District of Lianyungang City (7.5 – 4.4 ka BP), Guangfu Village Site in Wujiang District of Suzhou City (6 ka BP), Longnan Village Site (5.2 – 4.7 ka BP), Yaodun Site in Huqiu District (4.5 ka BP), Weidun Site in Wujin District of Changzhou City (6.2 – 5.1 ka BP), Qingchengdun Site (5.5 – 5.3 ka BP), Xujiawan Site in Zhangjiagang City (5.5 ka BP). There are 8 sites in Zhejiang: Xiatang Site in Xianju County (9 ka BP), Hehuashan Site in Longyou County (9 – 8 ka BP), Qiaotou Site in Yiwu City (9 – 8 ka BP), Jingtoushan Site in Yuyao City (8.3 – 7.8 ka BP), Hemudu Site in Yuyao City (7 – 5 ka BP), Puanqiao Site, Tongxiang City (5.5 – 4.5 ka BP), Shuangqiao Site, Xiuzhou District, Jiaxing City (5.3 – 4.0 ka BP), Yujiashan Site, Yuhang District, Hangzhou City (5 ka BP). There are 5 sites in Anhui: Dachendun Site in Feidong County (7 ka BP), Houjiazhai Site in Dingyuan County (7 – 6 ka BP), Hongdun Temple Site in Huoqiu County (6 ka BP), Mopanshan Site in Langxi County (6.2 – 2.5 ka BP), and Xianzong Site in Hanshan County (6.0 – 2.2 ka BP). There are 3 sites in Hubei: Chengbeixi Site in Yidu City (8.5 – 7.0 ka BP), Honghuatao Site (6 ka BP), Huangtugang Site in Zengdu District of Suizhou City (5 ka BP). There are 4 sites in Hunan: Songjiatai Site in Lixian County (9 ka BP), Fenshanbao Site in Junshan District of Yueyang City (9 – 5 ka BP), Dulingao Site in Chaling County (8 – 6 ka BP), and Qixingdun Site in Huarong County (5 – 4 ka BP). There are 2 sites in Chongqing: Daxi Site in Wushan County (6.4 – 5.3 ka BP), Zhongba Site in Zhongxian County (5 ka BP to Qing Dynasty).

2.2.4 Cultural relics protection units below the provincial level. The remains of prehistoric rice farming culture in the Yangtze River Economic Belt mainly involve 35 cultural relics protection units below the provincial level in 8 provinces and cities. Among them, there are 8 sites in Jiangsu: Caoyangang Site in Xinghua City (7 ka BP), Shendun Site in Liyang City (7 – 6 ka BP), Chidun Site in Huishan District, Binhu District, Wuxi City (7 ka BP), Yangjia Site (6.3 – 5.9 ka BP), Kunshan Shaoqingshan Site (7.0 – 5.3 ka BP), Jiangli Site (6 – 5 ka BP), Zhumucun Site (5.3 – 4.2 ka BP), Nanjing Beiyinyangying Site (6 – 5 ka BP), Gulou District, Nanjing City. There are 7 sites in Zhejiang: Huangchaodun Site, Qujiang District, Quzhou City (9.3 – 8.0 ka BP), Baziqiao Site, Jiangbei District, Ningbo City (7 – 6 ka BP), Dafen Site, Nanhu District, Jiaxing City (6 – 4 ka BP), Xiaodouli Site, Haining City (5.3 – 4.3 ka BP), Maoshan Site (5 ka BP), Bianjiashan Site (4 ka BP), Shuitianfan Site (5 ka BP) in Yuhang District, Hangzhou City. There are 4 sites in Anhui: Yuzhuang Site in Sixian County (8 ka BP), Miaodun Site in Fanchang County (7.0 – 6.8 ka BP), Yangbao Site in Yongqiao District of Suzhou City (7 ka BP), Jingshuidun Site in Jingxian County (4.9 – 2.6 ka BP). There are 5 sites in Hubei: Weiganping Site in Changyang Autonomous County (10 ka BP), Liulinxi Site in Zigui County (7 ka BP), Gongjiadagou Site (6 ka BP), Zhujiazui Site in Jingshan City (5 – 4 ka BP), and Xiezidi Site in Daye City (4.2 – 4.0 ka BP). There are 2 sites in Hunan: Fushanyuan – Huangjiayuan Site in Miluo City (9 – 5 ka BP) and Gaokanlong Site in Zhongfang County (5.0 – 4.6 ka BP). There is one site in Chongqing: Dadiping Site in Yunyang County (5.0 – 4.5 ka BP). There are 2 sites in Sichuan: Maiping Site in Hanyuan County (4.7 – 4.5 ka BP) and Youjun Site in Xichang City (4.5 ka BP). There are 6 sites in Yunnan: Yingpanshan Site in Changning County (5.3 – 4.6 ka BP), Touzuishan Site in Jiangchuan District of Yuxi City (5.0 – 3.9 ka BP), Dayindong Site in Guangnan County (4.0 – 3.8 ka BP), Xinguang Site in Yongping County (4.0 – 3.7 ka BP), Dahuayan Site in Longling County (3.8 ka BP), Mopandi Site, Yongren County (3.5 ka BP).

2.3 National archaeological site park National archaeological site park refers to a specific public space with important archaeological sites and their background environment as the main body, which has the functions of scientific research, education and recreation, and has national demonstration significance in the protection and display of archaeological sites. The National Cultural Heritage Administration has assessed 55 national archaeological sites parks and 80 archaeological sites parks. Among them, there are 21 national archaeological sites parks and 29 archaeological sites parks in the Yangtze River Economic Belt. A total of 19 enterprises in 7 provinces are closely related to the rice farming culture in this economic belt: Caoxieshan Archaeological Site Park and Longqiuzhuang Archaeological Site Park in Jiangsu; Liangzhu National Archaeological Site Park, Hemudu Archaeological Site Park, Majiabang Archaeological Site Park and Shangshan Archaeological Site Park in Zhejiang; Lingjiatan National Archaeological Site Park, Bengbu Shuangdun Archaeological Site Park and Yuhui Village Archaeological Site Park in Anhui; Panlongcheng National Archaeological Site Park, Qujialing National Archaeological Site Park and Shijiahe Archaeological Site Park in Hubei; Chengtoushan National Archaeological Site Park, Laosicheng Archaeological Site Park and Liye Ancient City Archaeological Site Park in Hunan; Jinsha National Archaeological Site Park, Sanxingdui National Archaeological Site Park and Baodun Ancient City Archaeological Site Park in Sichuan; Shizhaishan Archaeological Site Park in Yunnan.

2.4 Movable cultural relics Movable cultural relics, also known as collection cultural relics and collectible cultural relics, refer to important objects, works of art, documents, manuscripts, books and materials, representative objects, *etc.* in various historical periods. According to the National Cultural Heritage Administration's *Information on Movable Cultural Objects*, the movable cultural relics of rice farming culture in the Yangtze River Economic Belt are widely collected in Shanghai Museum, Shanghai Agricultural Reclamation Museum, Shanghai Qingpu District Museum, Wujiang Museum, Changzhou Weidun Site Museum, Changshu Jiangnan Farm Folklore Museum, Suzhou Museum

(Suzhou Folklore Museum), Longqiuzhuang Site Museum, Liyang Tianmuhu Wine Culture Museum, Hangzhou Museum, Hangzhou Xiaoshan Cross-Lake Bridge Site Museum, Liangzhu Museum, Yuyao Hemudu Site Museum, Jiaxing Museum (Jiaxing Majiabang Culture Museum), Anhui Rice Museum, Jiujiang Museum, Jingmen Qujialing Site Museum, Panlongcheng Site Museum, Longping Rice Museum, Xiaogan Matang Rice Wine Museum, Lixian Chengtoushan Ancient Cultural Site Museum, Hunan Shengyinxuan Misheng Cultural Museum, Changsha Jade and Vinegar Cultural Museum, Yongshun Laosicheng Museum, Chengdu Jinsha Site Museum, Sichuan Guanghan Sanxingdui Museum, *etc.*

2.5 Important agricultural cultural heritage Important agricultural cultural heritage is a unique traditional cultural system formed by the long-term co-evolution and dynamic adaptation of rural areas and their environment, especially the land use system and agricultural landscape.

2.5.1 Globally important agricultural cultural heritage. The Food and Agriculture Organization of the United Nations (FAO) has identified 22 globally important agricultural cultural heritages in China. Among them, there are 6 items closely related to the rice farming culture in the Yangtze River Economic Belt: the Traditional Agricultural System of Duotian in Xinghua, Jiangsu, the Rice-Fish Symbiosis System in Qingtian, Zhejiang, the Rice Farming Culture System in Wannian, Jiangxi, the Mountain Rice Terrace System in Southern China (Hakka Terrace in Chongyi, Jiangxi, Ziquejie Terrace in Xinhua, Hunan, Fujian Youxi Union Terrace, Guangxi Longsheng Longji Terrace), Guizhou Congjiang Dong People's Rice-Fish-Duck System, Yunnan Honghe Hani Rice Terrace System.

2.5.2 China's important agricultural cultural heritage. The Ministry of Agriculture and Rural Affairs has identified 189 important agricultural cultural heritages in China. Among them, 23 items are closely related to the rice farming culture in the economic belt: the Traditional Agricultural System of Duotian in Xinghua, Jiangsu, the Agricultural System of Sandy Land and Polder in Qidong, the Agricultural System of Lake and Wetland in Gaoyou; the Rice-Fish Symbiosis System in Qingtian of Zhejiang, the Yuanhu Rice Rotation System in Dongyang, the Rush and Rice Rotation System in Huanggulin of Ningbo, the Polder Agricultural System in Lougang of Wuxing, the Terrace Agricultural System in Yunhe, the Shaopi (Anfengtang) and Irrigated Area Agricultural System in Shouxian of Anhui, the Compound Agricultural System in Taihu Mountainous Area; Jiangxi Wannian Rice Farming Culture System, Chongyi Hakka Terrace System, Hubei Jingshan Rice Farming Culture System, Hunan Xinhua Ziquejie Terrace, Xinhuang Dong Xizangan Red Rice Planting System, Hongjiang Mountain Fragrant Rice Cultivation Culture System, Huayuanzila Tribute Rice Complex Planting and Breeding System; Farming Culture System in Linpan, Pidu, Sichuan; Fish-Duck System in Congjiang Dong People's Rice, Tunpu Agricultural System in Anshun; Hani Rice Terrace System in Honghe, Yunnan, Babao Rice Ecosystem in Guangnan, Rice-Wheat Multiple Cropping System in Jianchuan.

2.6 Intangible cultural heritage In 2004, China acceded to the *Convention on the Protection of Intangible Cultural Heritage*, and has now established a four-level intangible cultural heritage protection system at the national, provincial, municipal and county levels.

2.6.1 World intangible cultural heritage. According to the *Digital Museum of China's Intangible Cultural Heritage*, the UNESCO has selected 43 world intangible cultural heritages in China. Among them, there are three items closely related to the rice farming culture in the Yangtze River Economic Belt: the traditional production techniques of Xuan paper (originated from Anhui Province, with tough bark of the Tara Wing-Celtis or Blue Sandalwood tree and rice straw), the Dragon Boat Festival (originated in the economic belt, and has the custom of eating Zongzi), and the 24 solar terms (mainly originated from the economic belt, and guided its rice farming).

2.6.2 National intangible cultural heritage. According to the *Digital Museum of China's Intangible Cultural Heritage*, the Yangtze River economy has 18 national intangible cultural heritages closely related to rice farming culture. Among them, there are 2 items of traditional art: VII-54 straw weaving (Xuxing straw weaving, Hukou grass dragon, Muchuan grass dragon), VII-88 sugar sculpture (Fengxian sugar figurines, Tianmen sugar sculpture, Chengdu sugar painting).

There are 11 items of traditional techniques: VIII-60 Shaoxing rice wine brewing techniques, VIII-61 vinegar brewing techniques (Baoning vinegar traditional brewing techniques, Chishui sun-dried vinegar making techniques), VIII -62 Zhenjiang Hengshun vinegar brewing techniques, VIII-65 Xuan paper making techniques, VIII-144 traditional brewing techniques of distilling liquor (traditional brewing techniques of Wuliangye liquor, traditional brewing techniques of Shuijingfang liquor, traditional brewing techniques of Jiannanchun liquor, traditional brewing techniques of Tuopai liquor), traditional brewing techniques of distilling liquor (traditional brewing techniques of sealed jar liquor, traditional brewing techniques of Jinhua liquor), VIII-161 tea making techniques (Fuchun tea making techniques), VIII-207 Wufangzhai zongzi making techniques, VIII-235 Mengzi crossbridge rice noodles making techniques, VIII-266 Yandongguan Wujiapi brewing techniques, VIII-279 Kaili Fish in Sour Soup making techniques (including glutinous rice).

There are five folk customs: X-3 Dragon Boat Festival (Quyuan's hometown Dragon Boat Festival custom, Xisai Shenzhou Festival, Zelin Dry Dragon Boat, Miluo River Dragon Boat Festival custom, Daozhou Dragon Boat custom, Luodian Dragon Boat custom, Suzhou Dragon Boat Festival custom, Jiaxing Dragon Boat Festival custom, Wuchang Dragon Boat Festival, Jiangcun Dragon Boat Festival), X-68 the twenty-four solar terms of the lunar calendar (Jiuhua Spring Festival, Banchun Quannong, San-

men Winter Festival, Mid-level Summer Festival, Greater Heat Boat, Meiyuan Grain in Ear Plough Festival, Anren spring temple fair, Miao autumn temple fair, Shiqian Spring Singing Festival). X-71 the Lantern Festival (Yuyuan Garden Lantern Festival, Dragon Lantern Festival on the River, Qiantong Glutinous Rice Balls for Lantern Festival Guild, Shangban Guangong Lantern, Gannan Hakka Singing Boat custom, Baijie Dragon custom, Dejiang Fried Dragon Custom, Miao Dancing Dragon and Whistling Flowers custom), X-149 Rice Cultivation custom, X-174 Laba Rice Porridge Festival custom.

2.7 China time-honored brand China time-honored brand refers to a brand with a long history, products, skills or services inherited from generation to generation, distinct traditional Chinese cultural background and profound cultural heritage, which has been widely recognized by the society and has formed a good reputation. According to the *Catalogue of China Time-honored Brands* issued by the Ministry of Commerce, there are 708 China Time-honored Brands in the Yangtze River Economic Belt, of which 292 are closely related to the whole rice industry chain in the economic belt, involving rice and its primary processed food, rice paper, vinegar, rice wine, liquor, medicinal liquor, catering and so on. Among them, there are 65 in Shanghai, 51 in Jiangsu, 47 in Zhejiang, 19 in Anhui, 17 in Jiangxi, 17 in Hubei, 17 in Hunan, 14 in Chongqing, 32 in Sichuan, 4 in Guizhou and 9 in Yunnan.

2.8 Historical names and traditional markings Geographical indications mainly depend on natural and/or human factors[13-17]. Among them, the traditional specialty contains the factors of farming culture and inherits the historical names and traditional marks of the specialty. In the whole rice industry chain of the Yangtze River Economic Belt, there are 104 kinds of geographical indications products of rice and its products, 216 geographical indications trademarks of rice and its products, and 77 kinds of geographical indications of rice agricultural products.

2.9 Tribute culture Tribute culture is the product of the ancient tribute system. It is not only a material contribution, but also a cultural and political symbol. It has a long history in China, which can be traced back to the Dayu period (2 070 – 1 600 BC). Among the above-mentioned geographical indications products, geographical indications trademarks and geographical indications of agricultural products (Table 1), there are 27 kinds of geographical indications that inherit and apply tribute culture and have the word "tribute" in their names.

Among them, one kind from Jiangsu: Tribute rice from Zaohe; 3 kinds from Anhui: Huaining Tribute Rice Cake, Bailianpo Tribute rice, Yingjia Tribute Wine; 3 kinds from Jiangxi: Xinganhe Tribute Rice, Wannian Tribute Rice, Shicheng Tribute Rice; 3 kinds from Hubei: Guanmiaoshan Tribute Rice, Zhuxi Tribute Rice, Xuanen Tribute Rice; 2 kinds from Hunan: Yuquan Tribute Rice and Zila Tribute Rice; 3 kinds from Chongqing: Nanchuan Tribute Rice, Tongnan Luopanshan Tribute Rice, Youyang Tribute Rice; 6 kinds from Sichuan: Huanglong Tribute Rice, Jitian Tribute Rice, Kaijiang Tribute Rice, Wangjia Tribute Rice, Huangxi Tribute Rice, Shikong Tribute Rice; 5 kinds from Guizhou: Xifeng Xishan Tribute Rice, Chazhai Tribute Rice, Ginkgo Tribute Rice, Scilly Tribute Rice, and Mao Tribute Rice; one kind from Yunan: Zhefang Tribute Rice.

Table 1 Geographical indications of the whole rice industry chain in the Yangtze River Economic Belt

Province/city	GI products number of types	GI trademarks pcs	Agricultural GI products number of types
Shanghai	2	2	1
Jiangsu	8	49	8
Zhejiang	3	18	–
Anhui	10	18	8
Jiangxi	8	14	9
Hubei	18	39	18
Hunan	7	19	11
Chongqing	–	14	3
Sichuan	25	22	4
Guizhou	17	6	13
Yunnan	6	15	2
Total	104	216	77

2.10 Archival and documentary heritage The International Advisory Committee of the UNESCO World Memory Project confirmed that 17 archival and documentary heritages in China were included in the *World Memory Asia-Pacific List* and 15 archival and documentary heritages were included in the *World Memory List*. However, none of these archival and documentary legacies has much to do with rice farming culture.

Chinese agricultural books of past dynasties, local chronicles of the Yangtze River Economic Belt, as well as some paintings and poems, often contain rice farming culture, and even rice varieties. There are abundant rice farming culture archives and documents in the *List of Chinese Archives and Documents Heritage*, such as *Guanzi Diyuan*, *Manual of Rice Varieties in Jiangxi Province*, *Pictures of Agriculture and Sericulture*, *Comment on Rice Varieties in Taihu Region*, *etc. Guanzi Diyuan*, written in the Warring States Period (475-221 BC), recorded 10 rice varieties and their suitable soil conditions for cultivation. The *Manual of Rice Varieties in Jiangxi Province*, completed in 1 090 – 1 094, is the earliest record of rice varieties in the Yangtze River Economic Belt so far, including rice names, rice products, planting, rice cultivation, manure soil, prayer and so on. The names, characteristics, origins, sowing, transplanting and harvesting time, cultivation techniques and management methods of 56 rice varieties (including japonica rice, indica rice and glutinous rice) in Jitai Basin of Jiangxi Province in Song Dynasty were recorded in detail. The 21 ploughing maps in the *Pictures of Agriculture and Sericulture* painted in the Shaoxing period of the Southern Song Dynasty (1 131 to 1 162) shows the whole process of rice cultivation in the Southern Song Dynasty from soil preparation, seed soaking, germination,

seedling raising, transplanting, cultivation, fertilization, irrigation to harvesting, threshing, drying and warehousing, which is a vivid portrayal of rice cultivation techniques in the Southern Song Dynasty in the Yangtze River Economic Belt. The *Comment on Rice Varieties in Taihu Region*, written in the early or middle 16th century, recorded 36 rice varieties (including japonica rice, indica rice, glutinous rice and ratooning rice) in the Taihu Lake area of the Ming Dynasty, and described the variety names, growth period, plant morphological characteristics, plant physiological characteristics, and so on.

3 Main problems in the inheritance and development of rice farming culture

3.1 Serious loss of traditional knowledge and culture The biodiversity of rice (*Oryza* L.) in the Yangtze River Economic Belt has been seriously threatened. In particular to wild rice (*O. rufipogon* Griff.), medicinal rice (*Oryza officinalis* Wall. ex G. Watt), wart-grain rice (*Oryza granulate* Nees et Arn. ex Hook. f.). Many of the unique traditional rice farming culture systems formed by the long-term co-evolution and dynamic adaptation of the local environment have been improperly changed or seriously damaged. The traditional knowledge of rice cultivation and the processing technology of traditional rice specialties have also been seriously lost.

3.2 Inadequate protection of immovable material cultural heritage The immovable material cultural heritage of the farming civilization in the economic belt is poorly protected. There are only three world cultural heritages of rice cultivation. The protection of cultural relics related to prehistoric rice farming culture is weak, with only 70 at the national level, accounting for only 51.85%, and there is no one at the national level in Chongqing and Guizhou; there are 30 at the provincial level, accounting for 22.22%, and there is no one at the provincial level in Shanghai, Jiangxi and Guizhou; there are 35 below the provincial level, accounting for 25.93%.

3.3 Protection of archival and documentary heritage to be strengthened The collection and collation of archival and documentary heritage related to rice farming culture is not enough. It has only been included in the *List of Chinese Archival and Documentary Heritage*, but not in the *World Memory Asia-Pacific List* and the *World Memory List*. It is necessary to promote the protection and digitization of national ancient books, give full play to the role of the birthplace of rice farming culture in the world, and enrich the memory of farming civilization in the Asia-Pacific region and the world.

3.4 Environmental archaeology obviously lagging behind Environmental archaeology in China is more based on stone, bronze, ceramics, iron, bricks and tiles, animal bones and other human activities that are easy to preserve, while the study of planting remains that are not easy to preserve is relatively weak. Archaeological research on primitive agricultural environment has always focused on dry farming in the Yellow River Basin and its millet, while less on primitive agriculture in the Yangtze River Economic Belt, especially on rice farming. There are many national and provincial key cultural relics protection units in this economic belt since the Neolithic Age, and there is no record of rice silica body and pollen. In a word, the environmental archaeology of rice farming culture in the Yangtze River Economic Belt is obviously lagging behind.

3.5 Exploration of origin of farming civilization not receiving due attention At present, the Project of Exploration of the Origins of Chinese Civilization is still closely linked to the hypothesis that Chinese civilization originated from the Yellow River Basin, mainly located in the Yellow River Basin, and its primitive agriculture focuses on dry farming such as millet in the Yellow River Basin. The exploration of the origin of farming civilization in the Yangtze River Economic Belt has not received due attention. It has ignored the important facts: the farming civilization in the middle and lower reaches of the Yangtze River is thousands of years earlier than that in India, Japan, South China, the Yunnan – Guizhou Plateau, and the Yellow River Basin. In the history of Chinese and world civilization, the farming civilization in the Yangtze River Basin is no less than that in the Yellow River Basin.

3.6 Weak system concept of rice farming culture activation The inheritance and development of rice farming culture in this economic belt often lacks systematic concepts and the pattern of rice industry chain, is limited to rice farming culture, neglects various customs related to clothing, food, housing and transportation derived from rice farming, and is often out of touch with the construction of wetland parks and cultural parks, the utilization of ancient villages and minority villages, and the protection of famous towns, villages and streets in famous historical and cultural cities in China. The activation and utilization system is not perfect.

4 Strategies for the inheritance and development of rice farming culture

4.1 Protecting genetic resources and important agricultural cultural heritage, and maintaining the diversity of rice germplasm and rice farming culture system It is necessary to investigate the rice germplasm resources in the Yangtze River Economic Belt, in particular to wild rice (*O. rufipogon* Griff.), medicinal rice (*O. officinalis* Wall. ex G. Watt)), and wart-grain rice (*O. granulate* Nees et Arn. ex Hook. f.), give full play to the rice germplasm protection functions of China and the world's important agricultural and cultural heritage, national and international important wetlands, national wetland parks, national nature reserves, national and provincial biodiversity observation stations, and the global biodiversity observation network, protect local rice germplasm resources, focus on building the national rice germplasm medium-term bank (Hangzhou) and the national plateau *O. rufipogon* germplasm resource nursery (Menghai), introduce high-quality rice varieties and materials from home and abroad,

and maintain the diversity of rice germplasm resources, and investigate the unique traditional rice farming culture system, especially the land use system and agricultural landscape, create the important agricultural cultural heritage of rice cultivation in China and the world, and inherit the diversity of rice farming culture system.

4.2 Inheriting intangible cultural heritage and China time-honored brands, upholding integrity and innovating rice farming culture It is recommended to investigate the resources of intangible cultural heritage and old brands in the whole rice industry chain of the economic belt, especially the intangible cultural heritage of traditional rice products, to build the national and world intangible cultural heritage, to inherit China time-honored brands, to train representative inheritors and units, and to build the national intangible cultural heritage. Combining traditional Chinese villages with ethnic minority villages, famous towns and villages in famous historical and cultural cities in China, and national cultural and ecological protection zones, improve the activation and utilization system, uphold integrity and innovate rice farming culture.

4.3 Excavating the human factors of geographical indications, and inheriting traditional marks, historical names and tribute culture It is necessary to collect and sort out the traditional specialties of the whole rice industry chain in the Yangtze River Economic Belt and their traditional marks, historical names and tribute culture, excavate the humanistic factors of geographical indications, enhance the cultural connotation and brand value of these traditional specialties, and inherit the traditional marks, historical names and tribute culture.

4.4 Collecting and sorting out the heritage of archives and documents to enrich the cultural memory of the Asia-Pacific region and the world It is necessary to collect and sort out rice farming books and related local chronicles, poems and paintings in the economic zone, promote the protection and digitization of national ancient books, enrich the *List of Chinese Archives and Documents Heritage*, and promote the protection and digitization of national ancient books. Besides, it is recommended to strive to be included in the *World Memory Asia-Pacific List and World Memory List*, give full play to the advantages of the birthplace of rice farming culture in the world, and enrich the memory of farming civilization in the Asia-Pacific region and the world.

4.5 Adhering to and applying the concept of system to promote the inheritance and development of farming culture in the whole rice industry chain The Yangtze River Economic Belt should adhere to and apply the concept of system, start the whole rice industry in the belt, look at the various customs related to clothing, food, housing and transportation derived from rice farming, and promote the effective connection between the inheritance, innovation and development of rice farming culture and the construction of wetland parks and cultural parks, the utilization of ancient villages and ethnic minority villages, and the protection of famous historical and cultural cities, towns, villages and streets in China.

4.6 Strengthening the inheritance, innovation and development of rice farming culture, and leading the inheritance and development project of Chinese excellent traditional culture It is necessary to systematically strengthen the inheritance, innovation and development of rice farming culture in the economic belt, promote the census project of Chinese cultural resources, the inheritance and protection project of farming culture, the inheritance and development project of intangible cultural heritage, the protection and development project of old Chinese brands, the protection project of traditional Chinese villages, the revitalization project of traditional Chinese festivals, and the protection of national ancient books, and lead the inheritance and development project of Chinese excellent traditional culture with rice farming culture.

4.7 Focusing on the farming civilization and promoting the Project of Exploration of the Origins of Chinese Civilization We should carry forward the rice-farming culture in the Yangtze River Economic Belt, enhance the awareness of the birthplace of the world's rice-farming culture, focus on farming civilization, from rice, rice straw marks, cobs, rice leaves, chaff, starch grains, paddy fields, rice storehouses, rice phytolith, rice sporopollen, farm tools, wine workshop sites, agricultural landscape, archives and documents heritage, *etc.* The system recognizes and extracts farming civilization information since the Neolithic Age to promote Project of Exploration of the Origins of Chinese Civilization.

4.8 Building the Yangtze River National Cultural Park with rice farming culture as the main theme It is recommended to combine national and provincial archaeological sites parks and provincial cultural parks for rice crops with biological genetic resources, world cultural heritage, key cultural relics protection units, movable cultural relics, important agricultural cultural heritage, intangible cultural heritage, time-honored brands, historical names, traditional marks, tribute culture and archival and documentary heritage, promote rice farming culture scenic spots, develop rice farming culture tourism, and build the Yangtze River National Cultural Park with rice farming culture as the main theme.

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emotional engagement, well-being enhancement, and environmental stewardship. By doing so, traditional villages can achieve long-term sustainability while offering visitors transformative journeys that resonate emotionally and ethically.

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