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Water Conservation Scenic Spots in China: Developing the Tourism Potential of Hydraulic Projects and Water Resources

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Abstract: The reservoir-related tourism industry has been developed for leisure purposes since the 1970s and has gained popularity worldwide. To promote reservoir-related tourism in China, the Chinese government launched a "top-down" project titled "Water Conservation Scenic Spot" (WCSS) in 2001. However, because of the lack of reasonable planning, innovative ideas, and effective governance, there are some problems with WCSS constraining its development. To deal with those problems, it is necessary to have a holistic understanding of the WCSS situation. This study analyses the origin, status, opportunities, and challenges of WCSS development in China. The results show a trend of periodic increase in the number of WCSSs between 2001 and 2016, and WCSS development is unbalanced regarding regions and types. Moreover, the main issues for the WCSS include the failure to follow WCSS guidelines in practice, weak awareness of the scientific educational function, monotonous planning and construction, a lack of cultural preservation, insufficient funding, weak marketing, damaging of natural resources, destruction of clusters of animals and plants, land surface erosion, and landscape pollution. These adverse effects can be alleviated by strengthening supervision and fostering balanced development, promoting education and protecting cultural resources, distributing funding and enlarging popularity, controlling the amount of tourism, and avoiding overexpansion. Overall, the findings of this study can encourage the development of WCSSs in the future and are of significance in supporting the reservoir-related tourism industry.

Keywords: water conservation projects; water conservation scenic spots; tourism; opportunities and challenges; China

1. Introduction

Flood disasters are one of the deadliest and most devastating natural hazards that have frequently been reported worldwide during monsoon seasons [1,2]. Meanwhile, water scarcity, inherently the mismatch between water demand and availability, has been one of the most significant global risks, constraining the current and future development of nations [3,4]. The construction of water conservation projects, i.e., dams and reservoirs, water transfer projects, and irrigation infrastructure, has been a practical solution to floods, waterlogging, and water shortages through mastering and deploying surface water and groundwater [5–7]. In addition, these have brought significant benefits in navigation, power generation, flat tidal treatment, soil and water conservation, and water resource protection [5,8–10], despite some adverse impacts [11].

As another aspect, waterfront landscapes have been of interest to many tourists [12–15]. It has already been a popular trend for many cities and regions to redevelop waterfront areas, such as rivers,

bays, lakes, islands, harbours, and ports, for enhancing economic competitiveness and promoting a place brand [16]. There are many examples in Baltimore, Boston, New York, and San Francisco in America [17]; Toronto in Canada [18]; London and Dundee in England [19,20]; Hong Kong [15]; Auckland in New Zealand [16]; Sydney and Brisbane in Australia [21,22]; Dalian, Qingdao, Shanghai, and Xiamen in China [23]; and Thessaloniki in Greece [24]. Practices to create tourism-oriented waterfront areas can be divided into two categories. One is to give the highest priorities to tourism and leisure, aiming at forming marketable aesthetics and increasing attractions. Another is to incorporate tourism and leisure functions into water resources but keep the prime objective of water management [16,22].

Consistent with the second type, many water conservation projects have also been adopted for tourism and leisure purposes. Dating back to the 1970s, there were studies on the development of reservoir-related tourism industry. Madsen and Andrews [25] proposed requirements for planning multipurpose water conservation projects. In European countries, reservoirs have been a very significant component in rejuvenating local tourism industries. For instance, in Poland and Hungary, the opening of dam crowns near Solinskie Lake and Lake Tisza successfully attracted tourists, stimulating employment and income in local communities [26,27]. Bulgaria launched a national ArtReef-based project, in which artificial reefs were installed as unique decorations of lakes and reservoirs, supporting inland waterway tourism [28]. After the sixth World Water Forum in March 2012, the Électricité de France (EDF) and the World Water Council (WWC) worked collaboratively to develop hydropower reservoirs for multiple purposes, of which tourism was an essential sector [29]. Meanwhile, the sharing concept was proposed to guide the versatile use of hydropower reservoirs, in which Arenal in Costa-Rica, Cumberland and Tennessee Valley Authority in America, Durance-Verdon in France, and Arthurs Lake and Bronte Lagoon in Australia were included [30]. Currently, developing water conservation projects for tourism in the U.S. has been prevalent, and reservoirs have been very nice tourist attractions [31]. There also emerged many other famous water conservation tourist areas, like the Aswan Dam in Egypt and Three Gorges Dam in China. Furthermore, some studies on how to repair and mitigate environmental problems during water landscape development have been carried out [32–34].

China suffers from a severe water scarcity problem with per capita water resources of only about one-fourth of the world average [35]. Meanwhile, many places in China are under the threat of flood disasters [5]. To solve these problems, China adopted the "hard-path approach", with the construction of massive infrastructure like dams/reservoirs with dykes, river channel management, and flood diversion zones [5]. Since 1950, China has constructed more than 97,000 dams and 98,000 reservoirs, 46,758 hydropower stations, 268,476 water gates, 413,679 km of dykes and 424,451 pumping stations [11,36]. Some of them are magnificent and are characterised by good aquatic and ecological environments, beautiful landscapes, and profound culture and heritage areas. As a result, the government of China launched a "top-down" project titled "Water Conservation Scenic Spot" (WCSS or also known as Water National Park) for developing their tourism functions.

Nevertheless, there have been very few studies on the WCSS, which as a result is a barrier to WCSS development. With a lack of support of reasonable planning, innovative ideas, and effective governance, it is not uncommon to observe that many WCSSs are suffering various problems like monotonous development patterns, overexploitation, scenic pollution, and deteriorating original functions [37]. Consequently, this paper aims to analyse the origin, situations, opportunities, and challenges of WCSS development in China, which will take a robust approach to master the whole picture of innovative concepts from a macro perspective [7,38,39]. Afterwards, some suggestions will be proposed to deal with emerging problems and challenges during WCSS development.

2. Methodology

To provide people with a holistic picture of the development of the WCSS, this paper gives an overview identifying the concept and the situation of the WCSS in China, and the opportunities and challenges the WCSS faces. The research framework is shown in Figure 1.

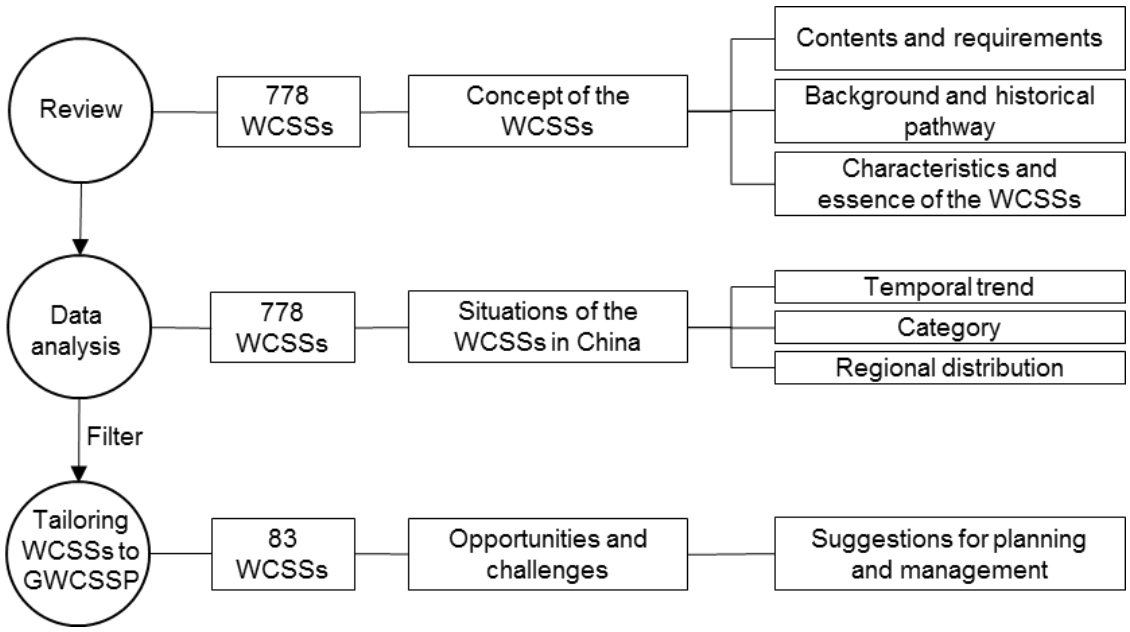

Figure 1. The research framework. WCSS (Water Conservation Scenic Spot) and GWCSSP (Guideline for water conservation scenic spot planning).

Prior to understanding the concept of the WCSS, it is required to identify the characteristics and the essence of the WCSS due to the various definitions of WCSSs. According to the multipurpose uses of water conservation projects, the characteristics and the essence can be represented by three aspects: the basis for developing a WCSS, holistically sustainable development, and the stakeholders. In addition to the identification of the scope, an illustration of the background and historic pathway of WCSSs enables understanding of their development history and promotion of their improvement. This study depicts the development of WCSSs from three stages: the starting stage (1980s–2000), the standardisation stage (2001–2010), and the mature stage (2011–2025), according to the management and guidance of national and local governments. At the standardisation stage, The Ministry of Water Resources of China (MWR) released the *Guideline for water conservation scenic spot planning* (GWCSSP) to strengthen the significance of ecological environment protection. This guideline defined the contents and requirements to enhance the quality of WCSSs in the context of the pursuit of rapid economic development. The 20 indicators in the guideline were further examined to identify opportunities and challenges of WCSSs in this study.

The temporal trend, category, and regional distribution of WCSSs were utilised to analyse the current WCSS situation in China. This study reviewed the trends of all 778 WCSSs in China during the period of 2001–2016. All these WCSSs are divided into six categories by MWR based on the local resources and conditions, including natural river and lake-type WCSS (NRL), reservoir-type WCSS (RES), wetland-type WCSS (WLD), urban river and lake-type WCSS (URL), irrigation-area-type WCSS (IRA), and water and soil conservation area-type WCSS (WSC). Also, the 778 WCSSs were distributed into Western, Central, and Eastern regions to compare the different and similar features in these regions. Moreover, a comparison based on the six categories in Western, Central, and Eastern regions was utilised to explore the relationship between categories and locations of WCSSs.

Although the GWCSSP was released to guide WCSS development, it is unclear whether this guideline can promote reasonable development or not. This study collected the overall planning documents of WCSSs including planning details such as vertical planning, landscape planning, and service facilities. Tailoring the overall planning documents of existing WCSSs and the GWCSSP enables us to identify the missing planning indicators in the development processes, which indicates the opportunities and challenges of WCSS development. Since this approach has high demands

on specific data such as Landscape planning and Water ecological protection and restoration, if the overall planning documents are not complete, this document cannot reflect the real situation of the WCSS and should be excluded. As a result, 83 WCSSs ranging from 2011 to 2014 were eligible by the screening process.

The data in terms of overall planning documents and the number, distribution, and category of WCSSs between 2011 and 2014 were acquired from the Ministry of Water Resources of the People's Republic of China. The number of WCSSs from 2001 to 2016 came from the MWR [37].

3. Concept of the WCSS

3.1. Characteristics and Essence of the WCSS

The WCSS, also known as a National Water Park, refers to a region that is built for sightseeing, entertainment, leisure, and vacation or scientific, cultural, and educational activities, depending on the water areas (water bodies) or associated natural landscapes and cultural landscapes that can attract people [40]. According to the multipurpose uses of water conservation projects, the essence of WCSS should include three aspects.

First, the basis for developing a WCSS is the "water resource", which means that the protection of water-related ecological environments and resources should be fully considered in scenic planning. The water conservation projects are primarily charged with social and environmental functions so that the tourism and leisure characteristics of the WCSS should to some extent give way to their primary features [5,16].

Second, a WCSS can be considered as an integrated approach to the holistically sustainable development of water conservation projects, in which the historical and humanistic properties are planned and operated to unleash their recreational potential beyond their basic services [29]. Apart from the natural landscapes of the WCSS making them attractive, the WCSSs have also exhibited some specialities. On the one hand, many WCSSs are characterised by long-history water cultures, making them distinct from other kinds of scenic spots and demonstrating their differences. Humanistic ideologies like "Emperor Yu tames the flood" and "The highest goodness is like water" is the essence and spirit of water conservation civilisation [41]. On the other hand, a WCSS serves crucial functions in outreach to and in cultivating people with water science, technology, and culture. These are in a variety of forms including records of ancient or early water control documents, water conservation sites, carved stone monuments, and so on.

Third, the multipurpose uses of a WCSS determine the engagement of all stakeholders, who should have distinct interests, preferences, and needs, possibly resulting in conflicts in planning, designing, operation, maintenance, and governance [29]. Nevertheless, the ideal expectation is to realise the harmony between water conservation projects and scenic spots, according to the full participation of different stakeholders, reasonable decisions, and outcomes [29,30]. Overall, planning of the WCSS gives priority to the development of water resource protection, and the development of tourism can bring funds for the construction, repair, and maintenance of water conservation projects.

3.2. Background and Historical Pathway

Considering the advantages of water conservation projects in beautiful landscapes, cultural connotations, and technical and scientific knowledge, the construction of a WCSS has been an approach to holistically promoting the development of water conservation projects. The WCSS can not only maintain ecological benefits in flood prevention, irrigation, power generation, water supply, and navigation, but also can bring prominent social and economic benefits through cultural heritage, popularising science, education, landscape modelling, and tourism development. Therefore, the developments of WCSSs have undergone or have been undergoing three stages—the starting stage (1980s–2000), the standardisation stage (2001–2010), and the mature stage (2011–2025)—according to the management and guidance of national and local governments, as shown in Figure 2.

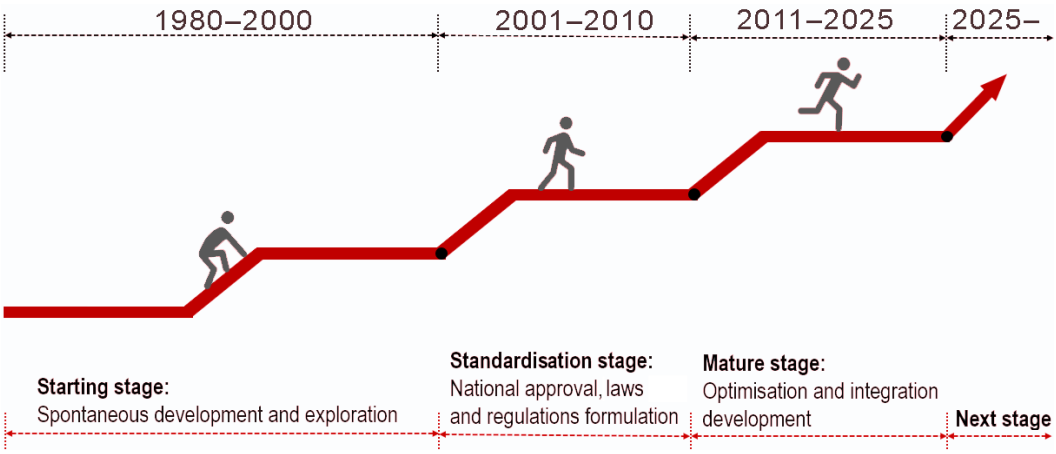

Figure 2. The development and primary stages of the WCSSs.

3.2.1. Starting Stage: Spontaneous Development and Exploration

In the past decades, a large number of water conservation facilities have been constructed, forming a variety of primary engineering systems including flood control, water supply, power generation, irrigation, and so on. Since the implementation of the "Open Door Policy" in 1978, many grassroots water management units, which are formed to develop the local economy, have spontaneously started to combine the natural advantages, like abundant biological diversity and agricultural production, of surrounding water conservation projects for small-scale tourism activities. These later enlightened the development of more water-related units to reduce the constriction of limited local resources for development.

Although it was an unconscious and unplanned behaviour, it laid the foundation for the formation of water conservation tourism, as government departments activated unprecedented enthusiasm for developing diversified water conservation projects, extending to many service industries including tourism. In 2000, government development formally implemented a new idea for a business, namely, the promotion of national water conservation tourist areas, which became the predecessor of the WCSS. Between the 1980s and 2000, the WCSS stayed in its starting stage. Overall, grassroots units spontaneously explored water conservation tourism in this stage, without the guidance of reasonable planning and precise rules and regulations. As a result, there were predatory exploitation cases in many areas, leading to water pollution and water conservation project damage.

3.2.2. Standardisation Stage: National Approval, Laws, and Regulation Formulation

To scientifically and reasonably develop and utilise water resources and protect ecological resources, the MWR launched an expert group, the WCSS Assessment Committee (WCSSAC), in 2001. At the same time, the title of "water conservation tourist area" was officially renamed to WCSS, as they are currently known. With the supervision of the WCSSAC, the development and planning of water conservation projects or water resources could be standardised, avoiding unscientific plans and overexploitation as well as possible damage. The WCSSAC approved 18 cases as national-levelled WCSSs, like Ming Tombs Reservoir (also known as the Shisanling Reservoir in Beijing) and Jiangdu Water Conservation Hinge Engineering (in Yangzhou, Jiangsu Province).

To further balance the relationships between development and conservation and to curb the phenomenon of overexploitation, the MWR determined the basic developing rule of the WCSS: planning at the forefront, in 2004. Accordingly, the MWR issued the *Administrative measures for water conservation scenic spots*, the *Management of water conservation tourism projects*, and the *Evaluation criteria for water conservation scenic areas*. The promulgation and formulation of these documents mainly regulated the development and management of WCSSs and formed a basis for the development of the WCSS. From 2001 to 2010, the MWR performed its function in approving the national WCSSs and

issuing effective laws and regulations. The latter is of vital importance to the WCSSs, making them a standardised management and development mode and indicating that the construction of WCSSs tended to be regulated and stable.

3.2.3. Mature Stage: Optimisation and Integration Development

Afterwards, the construction and development of WCSSs entered a mature phase. The concept of the WCSS has also been increasingly recognised by tourists, bringing valuable economic and social benefits to local people. According to statistics from the MWR, all WCSSs across China were visited by 1.77 billion domestic and foreign tourists in total, and the total tourism revenue was 1.26 trillion yuan (or 180 billion USD) during the "Twelfth Five-Year Plan" period [37]. WCSSs have become essential destinations for ecotourism [37]. Meanwhile, the construction of WCSSs has upgraded the environmental quality of surrounding areas. For instance, the sewage in all WCSSs achieves discharge standards, air quality in 60.6% of the WCSSs meets the first-class standard, and water quality in 31.4% of the reservoir-type WCSSs reaches class II or better [37]. With the rapid enhancement of social and environmental benefits, the quality of water conservation scenic spots should be increased to exploit the unique resource advantages for more significant development sustainably.

Therefore, the MWR strengthened the significance of ecological environment protection with the release of the GWCSSP in 2010. The guideline provides the philosophy to optimise and enhance the quality of WCSSs in the context of the pursuit of rapid economic development. The GWCSSP proposes that the planning ideas and concepts of the WCSS should follow the principle of "*promoting development through protection and promoting development through conservation*" and realise the goal of "maintaining water projects, ensuring water environment, protecting water resources, repairing water ecology, promoting water culture, developing water economy, and promoting harmony between man and nature" [40].

Furthermore, both successes and problems in WCSS construction have been accumulated and summarised, along with the increase in the number of WCSS practices. Therefore, the MWR advocated the future goal to optimise WCSS quality and to establish integrated service management systems. The appeal will be accomplished in two substages: the first stage (2017–2020) will alter the focus of the management pattern from appraisal to the integration of construction and supervision, to enhance the quality of the WCSSs. This period, at the same time, will further improve the management system, methods, standards, specifications, and technical guidelines to form a standardised, scientific, and orderly WCSS management system. The second stage will further encourage WCSS construction and promote upgrading and building brands. Based on these, a nationwide WCSS network will be formed, covering major rivers, lakes, and large- and medium-sized water conservation projects in China [37]. Overall, the ongoing mature stage fundamentally focuses on WCSS optimisation and the integration of construction and management, which requires extensive studies to support the future development of WCSSs.

3.3. Contents and Requirements

According to the GWCSSP issued by the MWR in 2010, the WCSS creation process should concentrate on nine items:

1. Resource investigation;
2. Status analysis and evaluation;
3. Principle and scope;
4. Target year and the task of water conservation planning;
5. Functional division of planning layout;
6. Special planning;
7. Capacity;
8. Cost-benefit;

9. Environmental assessment.

The sixth item, "special planning", is further subdivided into 12 terms, including Protection of water resource, Water ecological protection and restoration, Landscape planning, Transportation, Service facilities, Infrastructure, Land use, Vertical planning, Safety, Identification system, Water-related technique and culture, and Marketing and management [40]. All these items and subitems are considered the planning indicators of WCSSs, and their requirements are presented in Table 1.

Table 1. Planning indicators and planning requirements of WCSSs.

Indicators		Requirements
Resource investigation		• Collect and analyse the data of the water conservation scenic spot regarding nature, culture, society, economic, water resources, and water engineering
Status analysis and evaluation		• Identify existing problems and causes in the development process based on resource investigation • Evaluate hydrological, geomorphological, astronomical, biological, and engineering resources and the cultural landscape • Identify strengths and weaknesses of development and put forward the opportunities and challenges of the construction and development of scenic spots
Principle and scope		• Follow the principles of people-centeredness, adapt to local conditions, persist in overall consideration, and support sustainable development, as well as highlight the concept of maintaining water projects, protecting water resources, improving water environment, rehabilitating water ecology, promoting water culture, and developing water economy and reflect the scientificness, reasonability, and operability • Define the scope of planning based on the need for developing scenic area resources • Define the scope of protection based on planning to identify the completeness of landscape resources, the relative independence of geographical units, the feasibility of utilisation and management, and the actual needs of aquatic ecological protection
Target year and the task of water conservation planning		• Select data-available year as target year of water conservation planning • Propose short-term, mid-term, long-term responsibility according to economic, social, ecological, and engineering development
Functional division of planning layout		• Arrange and coordinate reasonably in the planning of a water conservation scenic spot • Design the functional areas and arrange the corresponding projects and facilities based on full consideration of the spatial relationship and traffic relations between the nodes
Special planning	Protection of water resource	• Analyse the changes in water quality that may be caused by the construction and development of scenic spots to predict the indicators of water environmental carrying capacity and water pollution capacity in the planning area • Put forward specific measures for water quality protection to ensure the quality of water bodies • Analyse the water supply and demand balance, optimise the allocation of water resources, and arrange the production, living, and ecological water use of the scenic area
	Water ecological protection and restoration	• Analyse and predict possible changes in the aquatic ecological environment, and propose water ecological and environmental protection measures near aquatic areas and shorelines • Propose water ecological restoration measures according to the ecological water problems of damaged rivers and lakes (reservoirs) • Protect biodiversity and provide clear protection measures for biological resources, rare species, and communities
	Landscape planning	• Respect and protect natural and cultural relics, excavate and promote local cultural characteristics, make rational use of landscape elements, and shape characteristic landscapes
	Transportation	• Plan external traffic consisting of utilising full advantage of social traffic conditions and maintaining the relationship between the scenic and external environments • Plan internal transportation including building effective connections between waterways and land routes, rationally arranging piers, parking lots, etc., and reasonably classifying roads according to the actual conditions to ensure that tourists can safely and efficiently reach scenic spots within scenic areas • Use environmentally friendly vessels and vehicles in scenic areas to avoid air and water pollution

Table 1. *Cont.*

Indicators		Requirements
Special planning	Service facilities	• Set up scenic area service facilities to provide fast and convenient services for tourists to eat, live, travel, purchase, and find entertainment
	Infrastructure	• Build infrastructure based on the requirements of scenic area construction and management
	Land use	• Propose a demand forecasting plan for land size, structure, and spatial distribution in planning areas based on the analysis and assessment of the current situation of land resources and land use in scenic areas • Formulate the near-term, mid-term and long-term land use plans for scenic areas, and list the land use balance sheet following the requirements of local urban and rural development plan standards
	Vertical planning	• Determine the location and elevation of buildings, sites, and roads at essential nodes
	Safety	• Consider engineering safety, flood safety, visitor safety, fire safety, etc.
	Identification system	• Arrange the position, quantity, and style of identification signs and attractions and introduction signs reasonably distributed utilising text, images, and symbols, labelling information and other attractions and facilities for visitors
	Water-related technique and culture	• Set up corresponding water technology and water culture display facilities • Define requirements for the theme, content, and forms of expression of water science and technology and water culture communication displays
	Marketing and management	• Comprehensively deploy scenic area image designs, marketing measures, marketing methods, marketing channels, etc.
Capacity		• Control the number of visitors to scenic spots and related attractions and determine visitor capacity based on the carrying capacity and environmental capacity of scenic areas
Cost-benefit		• Estimate the investment in the construction of scenic areas and related projects, make arrangements for investment in the near, medium, and long-term, and evaluate the benefits of scenic area construction, including economic, social, and ecological benefits
Environmental assessment		• Comply with the relevant provisions of environmental impact assessments of the planning of the water conservation industry and the requirements of the relevant technical documents

In the preservation of water resources and environments, since the leisure and tourism functions cannot sacrifice local water quality, biodiversity, natural landscapes, or cultural heritage, etc., the configurations of supporting infrastructure and marketing systems and commentary should also give priority to environmental protection. Overall, WCSS development should be a less market-oriented practice.

4. Situations of WCSSs in China

4.1. Temporal Trend

In 2001, the MWR approved the first batch of 18 WCSSs. Since then, the MWR has reviewed and issued new WCSSs every year. By the end of 2016, the MWR had approved 16 batches for a total of 778 national WCSS cases across the country of China, as presented in Figure 3. For the first three years of 2001, 2002, and 2003, the number of yearly approved cases was lower than 40, after which the number of new spots was consistently higher than 40 (except for the year of 2007—38 in number), even reaching 70 in the years of 2013 and 2014. In addition, the yearly approved WCSS cases also exhibited a trend of periodic increase, with mean numbers of 28.3 (2001–2003), 45.8 (2004–2008), 51.0 (2009–2012), and 65.0 (2013–2016).

4.2. Category

Although all WCSS cases are the composition of natural and cultural landscapes according to the definition of WCSSs, characteristics including natural resources, social humanities, economic development, and engineering projects that focus on the development of a WCSS vary significantly.

Therefore, according to the local resources and conditions, WCSSs have been divided into six categories, including NRL, RES, WLD, URL, IRA, and WSC, as shown in Table 2.

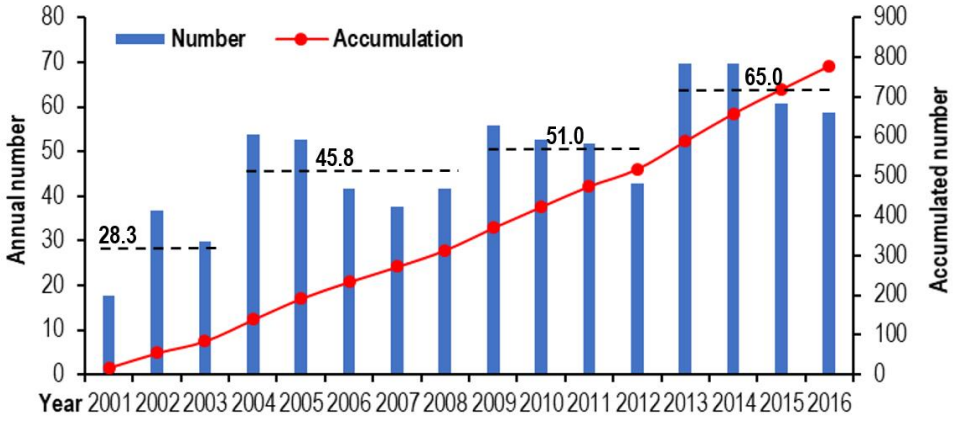

Figure 3. The annual and total number of newly approved WCSS cases in China (due to the end of 2016).

Table 2. The resources, requirements, and proportions of different types of WCSSs (due to the end of 2016).

Type	Resources	Construction Requirements	Number	Proportion (%)
NRL	Natural landscapes of rivers and lakes	Following the conditions of maintaining and protecting the natural features of rivers and lakes, necessary transportation and communication facilities can be configured to improve the accessibility of WCSSs.	166	21.3
RES	Magnificent artificial landscapes, vibrant cultural landscapes, and high technology	Based on the principle of water and soil conservation and ecological restoration, infrastructure such as transportation, communications, and water, power, and gas supply can be improved. Meanwhile, in conjunction with the management of water conservation projects, the exhibition of water technology and water culture should be highlighted.	364	46.8
URL	Water landscape, culture, and ecology	This type should be comprehensively planned, managed, dredged, and protected to strengthen the water attraction and make urban rivers and lakes leisure, sightseeing, and entertainment areas with beautiful environment and scenery and distinctive cultural features.	161	20.7
WLD	Abundant terrestrial and aquatic animals and plants	By protecting the aquatic ecological environment, the holistic management of water sources and ecosystems should be emphasised. Meanwhile, the extension of water flow and the use of ecological techniques to enrich species and enhance biodiversity should also have priority.	34	4.4
IRA	Complex landscapes like engineering projects, nature, drainage network, pastoral and water culture	These scenic spots can be constructed with a combination of ecological agriculture, sightseeing agriculture, modern agriculture, and service agriculture, with supplements of essential infrastructure and service facilities.	21	2.7
WSC	Integration of water and soil conservation projects, ecological protection, and landscapes	These can be built within the scope of national key soil erosion control areas (or demonstration areas for water conservation and as demonstration parks for science and technology), focusing on prevention and protection, key supervision, and key remediation.	32	4.1

As observed in Table 2, the resources that most WCSS projects depend on are natural landscapes, water conservation projects, regional cultural resources, and infrastructure. Among them, the natural views are the basis and principal component of WCSS projects, water conservation projects and infrastructure are the prerequisites for WCSS construction, and regional culture is the most distinctive sector. In China, the most prevalent type is the RES, accounting for 46.8%, more than 2 times higher than the proportions of NRL (21.3%) and URL (20.7%). The remaining WLD, IRA, and WSC account for very small proportions of 4.4%, 2.7%, and 4.1%, respectively. Overall, the different percentages indicate the significant imbalances in exploiting resources for WCSSs.

Meanwhile, Figure 4 presents the number of annual approved WCSS projects according to their types. The yearly approved RES was dominant from 2001 to 2013, further verifying the over-reliance on RES. However, the yearly constructed NRL and URL showed a trend of rapid increase and surpassed RES after 2013. In addition, WSC showed a trend of slow growth, but its number stayed at low levels. According to the newly constructed WCSS projects from 2014 to 2016, Figure 4 shows that the WCSSs tended towards diversification.

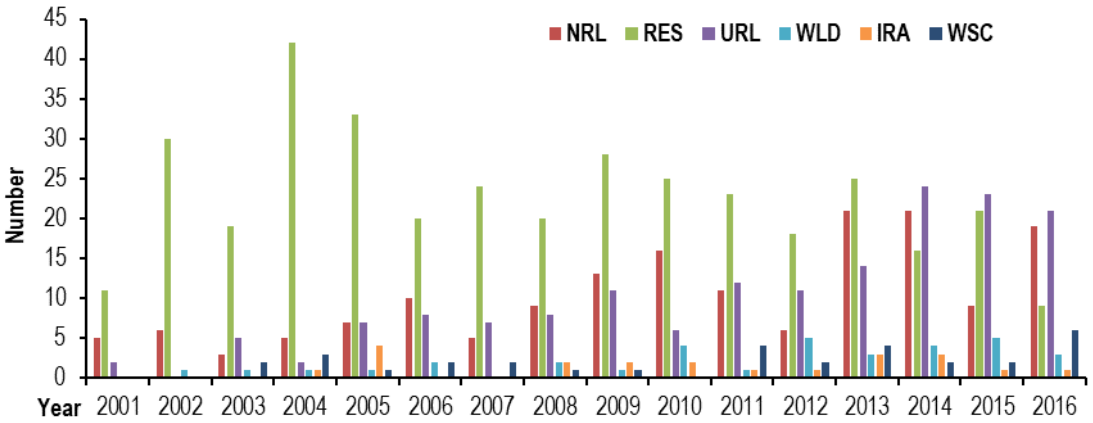

Figure 4. The number of newly approved WCSS cases according to types (2011–2016).

4.3. Regional Distribution

In examining economic development, the WCSS can be divided into three categories: Eastern regions, Central regions, and Western regions. The average numbers of WCSS projects in the eastern and central regions are almost 25 and 32, respectively, which are higher than that in the western region by 20. This might be attributable to the larger population and the more advantageous economy in eastern and central areas, which means higher demand for the development of WCSSs as well as more investment in WCSS construction.

Figure 5 illustrates the number of WCSSs in each province. The provinces with more than 30 WCSS projects are mainly in the eastern region, where many water bodies are surrounding the middle and lower reaches of the Yangtse River and the Yellow River. Although the Qinghai–Tibet Plateau is famous for its abundant natural water resources, there is a small number of WCSSs on the plateau because of the poor economy, low demand, harsh environment, and high construction difficulties.

Although the majority of WCSSs are in the eastern and central regions, most NRL projects are in the western region, as shown in Figure 6. The NRL projects in the western region account for 42% of the total NRL projects in China. This is because the western region is the origin of many rivers, providing the western region with significant advantages to build NRL. In Qinghai Province, for example, there are many west-to-east large mountains, along which numerous lakes and rivers form, resulting in predominant natural resources and landscapes. Also, there is a combination of the influences of climate and precipitation, as well as the location of the middle and lower reaches of many rivers. East China is also characterised by abundant natural river and lake resources. Therefore, in this region, the proportion of NRL is relatively high.

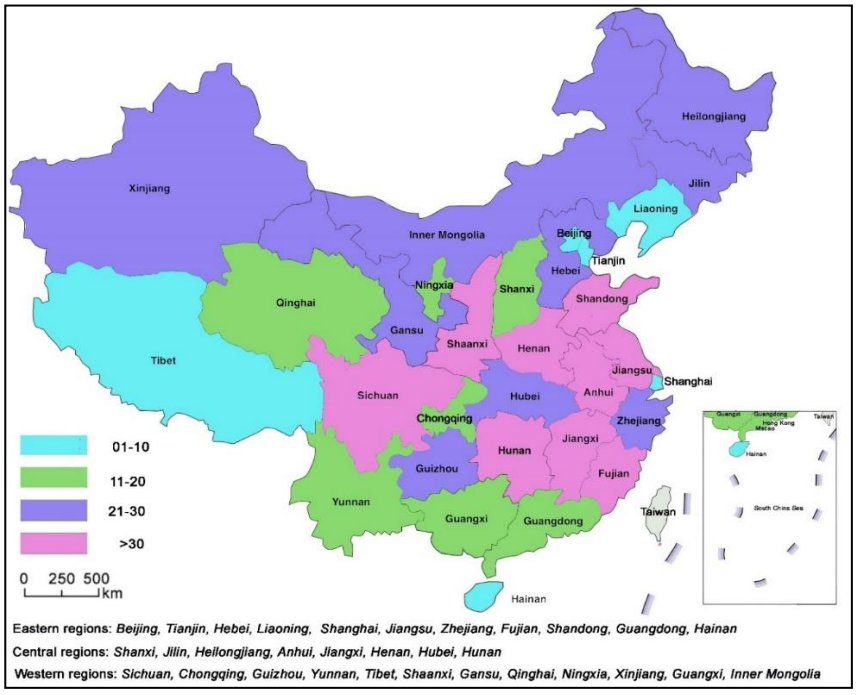

Figure 5. The number of WCSSs at the provincial level from 2001 to 2016.

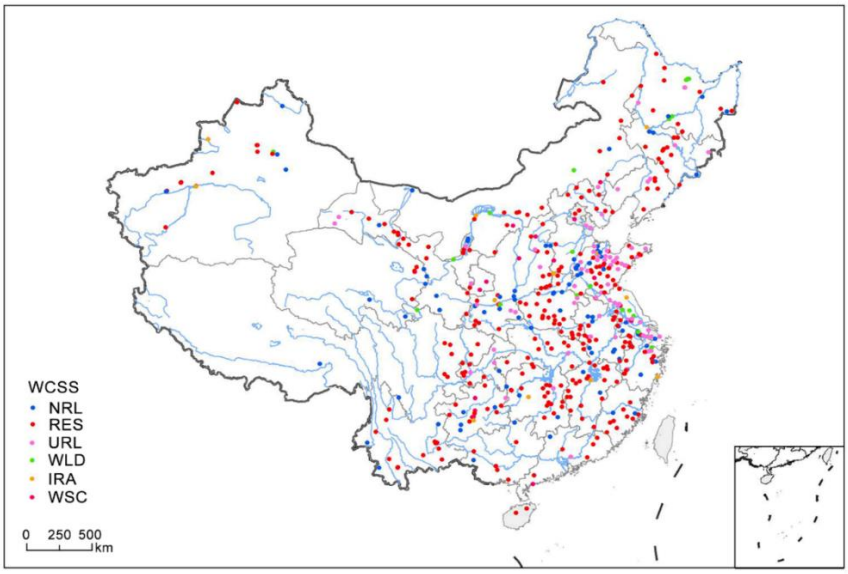

Figure 6. The spatial distribution of the six types of WCSSs from 2011 to 2014 (base map downloaded at http://bzdt.nasg.gov.cn/).

The RES category is less restricted by region and mostly accounts for a sizable proportion in many provinces and municipalities. For instance, RES projects in Jiangxi and Henan occupy high proportions. This is because the reservoirs are under the supervision of individual institutions that are affiliated with the water conservation system, which means that these institutions are more familiar with and enthusiastic about the application of the WCSS. Comparatively, other types of WCSSs are under the supervision of several entities, making the management complex. As a result, these entities have insufficient awareness and understandings of the WCSS, reducing their enthusiasm for and efficiency in the WCSS. All of these to some extent reflect the lack of experience in WCSS construction at the early stage.

The distribution of the URL type corresponds to the characteristics of economic development. The eastern region has high economic advantages, resulting in high requirements for leisure and

tourism, as well as high demands on URL. Overall, URL in the eastern region accounts for 66% of the total number of URL in China, most of which are in prefecture-level cities, county-level cities, and administrative counties.

There are 34 WLD projects in China, accounting for a small proportion of all WCSSs. Since WLD highly depends on the limited wetland resources, only a few areas are feasible for their development. The majority of WLD are in Jiangsu Province and Heilongjiang Province with seven and eight projects, respectively. Furthermore, the number of IRA projects is only 21, the lowest of all types of WCSS. Nevertheless, there is no significant difference between the numbers of IRA in eastern, central, and western areas. Due to its function of irrigation, the IRA type is in some major irrigation areas in China. Comparatively, WSC is mainly in eastern and western regions—about 85% of the WSC nationwide—and fewer are in the central region. This is possible because the western region frequently experiences natural hazards such as the earthquake in 2008 in Sichuan province, and eastern region land changes make a concession to economic development such as converting green space to commercial space [42]. In this type of area, it is urgent to prevent soil erosion, which leads to a high proportion of WSC. Overall, the development of WCSSs is unbalanced in type and in spatial distribution.

5. Opportunities and Challenges

5.1. Planning Requirements and Implementation

Planning guidelines are extremely vital for the sustainable development of WCSSs since they allow decision-makers to plan for the future and estimate possible outcomes [43]. However, it is arduous to formulate a comprehensive set due to limited experience in WCSS construction. Given this, the MWR issued the GWCSSP in 2010 to guide the holistic development of WCSSs. This national guideline consists of 20 planning requirements which enable planners to gain a thorough understanding of WCSS options and which are compulsory for new WCSS construction. However, it is known that most WCSS projects constructed between 2011 and 2014 failed to completely follow these requirements in practice, as shown in Figure 7.

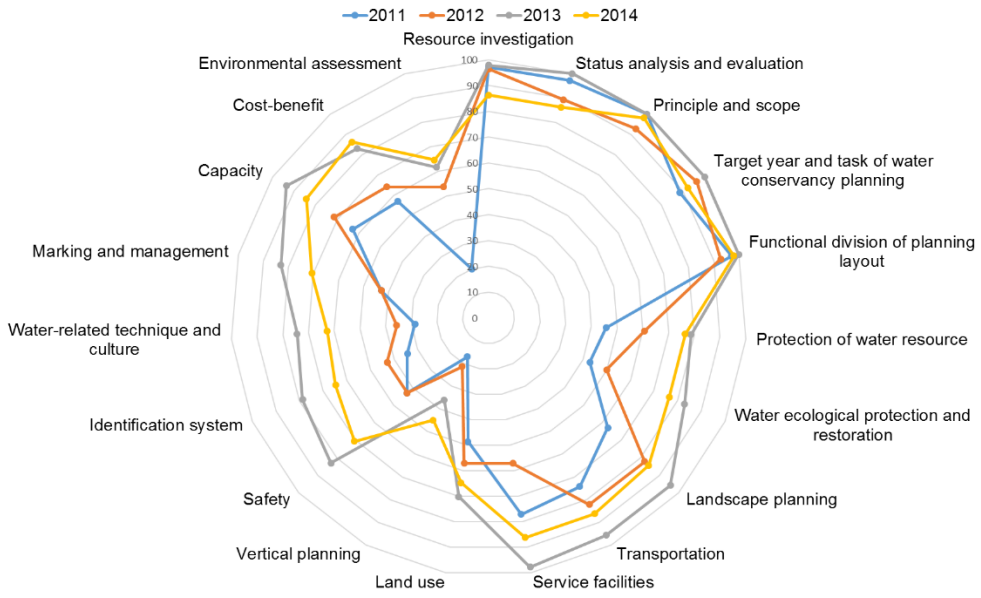

Figure 7. The percentage of completeness among different WCSS types from 2011 to 2014.

Furthermore, we introduce the completeness rate referring to the ratio of the number of planning requirements achieved by recent WCSSs and the total number of the indicators, to better understand the pattern of how existing projects follow the WCSS requirements. We recorded 19 requirements in this study, where the "service facilities" and "infrastructure" were combined into one group. It is shown

that the average completeness rate of WCSS projects constructed from 2011 to 2014 was more than 70%, meaning that most decision-makers followed the planning requirements in the planning. However, future WCSS projects are required to improve the completeness rate since still 28.1% of the planning requirements are missing in real cases, especially the requirements in the environment and cultural aspects. As shown in Figure 7, the figures of the completeness rate for "environmental assessment" and "water-related technique and culture", for example, are only almost 50%. This indicates the planners and decision-makers have insufficient awareness of environmental protection and cultural transmission. This might also be because the investment in these aspects cannot bring benefits to stakeholders in the short run [44,45].

In addition, the weakness in the special planning is another factor contributing to incomplete planning. Special planning is an essential component to holistically develop WCSS projects because it can fill the gap between high-level policies and local conditions, but most WCSS projects omit it in practice. For example, the completeness rate of the "vertical plan" is only 30%. This might be a contradiction between the high dependence on detailed information of local conditions and the difficulty in offering sufficient materials. Nevertheless, this problem can be overcome by the advance of data collection technologies and in-depth cooperation and collaboration between different institutions.

The average completeness rate showed a trend toward increasing—18.3% from 2011 to 2014. For specific requirements, the rates of "environmental assessment", "water-related technique and culture", and "marketing and management" increased by 30%. This improvement aligned with the increasing attention given to environmental protection and sustainable development. Meanwhile, it shows that the WCSS requirements actively encouraged new WCSS construction. However, from 2013 to 2014, the completeness rate reduced by 6%, revealing some uncertainties in the development process. In another aspect, the expansion of WCSS projects might lead to a decreasing trend in planning quality, which may pose a threat to the long-term development of WCSSs. Examples of "resource investigation" and "status analysis and evaluation" were the lowest in 2014 with only 86%, partly because planners ignored the feasibility analysis and complete preparation to facilitate the rapid development of WCSSs. Therefore, further work should focus on developing higher-quality WCSS projects.

Also, through the analysis of WCSS project completeness rates with different types, it was found that the rate of WLD is the highest, above 85%, while that of NRL is the lowest, below 65%. The difference is mainly attributable to the requirements on "safety", "identification system", and "water-related technique and culture". Specifically, the differences in these aspects between WLD and NRL were almost 40%. Therefore, it is essential to ensure the completeness rates of "safety", "identification system", and "water-related technique and culture" for NRL. To sum up, although the planning of WCSSs has become more comprehensive, the existing WCSS projects are still imperfect.

5.2. Water Conservation Promotion and Possible Damage

WCSSs could provide a kind of science education with social welfare aspects. Although WCSSs cannot impart knowledge to the general public systematically, WCSSs have advantages of tutoring the public by combining theory and practice. For instance, science museums can illustrate hydraulic knowledge in real cases and reveal the process of scientific planning. Also, the development of WCSSs has the function of technological improvement. For example, the development of RES projects based on water conservation requires sand and water regulation through the use of a Geographic Information System, a Global Positioning System, Remote Sensing, and Communications Technology. This can make a significant contribution to their improvement.

However, the science education function has gained enough attention, and yet almost half of the existing WCSS projects are incapable of accomplishing the scientific educational function. Figure 8 shows the completeness rates of educational planning indicators. The average value of "water-related technique and culture" from 2011 to 2014 was 50.5%. For NRL, the value was less than 40%. Therefore, it is urgent to improve the promotion of water conservation.

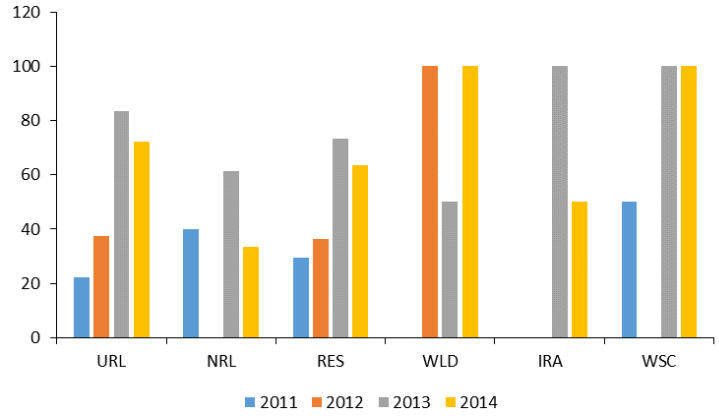

Figure 8. The rate of completeness of water-related technique and culture during 2011–2014.

Other barriers to the development of WCSSs are monotonous planning and construction and the lack of cultural preservation. Most WCSS projects are in suburban and rural areas where they are characterised by inconvenient traffic, lower population, and low popularity [46]. Since these areas are eager to attract tourists and promote the economy, they possibly utilise shortcuts that cater to the public. For example, planning extreme activities is popular in China, which contributes to attracting more young people. These shortcuts enable valuable benefits in the short term. Unfortunately, the resources for protecting traditional culture decrease as concessions to commercial activities and facilities are made. In the long term, WCSSs not only lose their uniqueness but are also not able to protect the culture and even destroy cultural relics.

Furthermore, planning requirements are not able to promote cultural preservation. All planning indicators can be divided into five categories—preparation, tourism, ecology, society, and economy—according to their function (as shown in Table 3). It is shown that the culture function of WCSSs had been ignored. Therefore, future work should be conducted to explore the unique cultural features that enhance the attraction and quality of WCSSs.

Table 3. Classification and analysis of the planning content of WCSSs.

Categories	Planning Indicators
Preparation	• Resource investigation • Status analysis and evaluation • Principle and scope • Target year and the task of water conservation planning • Functional division of planning layout
Tourism	• Landscape planning • Transportation • Service facilities • Infrastructure • Land use • Vertical planning • Safety • Identification system
Ecology	• Protection of water resource • Water ecological protection and restoration • Capacity • Environmental assessment
Society	• Water-related technique and culture
Economy	• Cost-benefit • Marketing and management

5.3. Economic Benefits and Initial Investments

WCSSs have the function of providing the public with opportunities for tourism and recreation, as well as providing flood control and natural hazard prevention. Meanwhile, WCSSs promote the development of the tertiary industry, accelerating regional economic growth. Almost all WCSS projects are in suburban and rural areas where there are numerous natural landscape and ecological resources. One of the barriers is the inconvenient traffic they create due to the immature physical infrastructure of these areas. Tourists, therefore, are inclined to stay overnight to reduce the stress of travel. This can further offer opportunities for the development of service industries like food service, accommodation, and tourism products. All these services help both local governments and residents to earn profits.

The economic prosperity initiated by WCSSs can create more employment opportunities. Due to the few job opportunities in suburban and rural areas, numerous workers are hunting for jobs away from home. As a result, they have a hard time taking care of their family, which has adverse effects on the possibility of a family reunion. WCSSs can generate job opportunities as the developed and tertiary industries require numerous workers. For example, the increasing requirement for tourism products attracts entrepreneurs and investors to set up factories, bringing employment opportunities to local workers.

However, the initial investments are insufficient in the development of WCSSs in many areas. As a result, the tourism potential is limited [47]. Another economic barrier is the low awareness of marketing. Marketing is a vital method to gain popularity that can attract more tourists and increase revenue. However, "marketing and management" is the weakest link in the development of WCSSs. Its average completeness rate was only 60% from 2011 to 2014, and only 43% for 2011 to 2012. This indicates that "marketing and management" has not gained enough attention at the beginning stage of planning.

5.4. Water Resource Protection and Ecological Degradation

WCSSs are usually built for natural hazard prevention and tourism, but they should enable natural resource protection as well. In practice, the development of WCSSs and tourist activities more or less lead to some damage to the ecological environment and natural resources. There are four types of damage, as shown in Table 4: damaging natural resources, destruction of clusters of animals and plants, land surface erosion, and landscape pollution. Although these types of damage cannot be avoided entirely because of anthropogenic activities, it is mandated to alleviate the devastation through rational planning and proper management. To better guide planning and management, the government further issued a regulation in 2015 with three tasks: review development, effective supervision, and brand promotion. It focuses on the improvement of water resource protection and ecological water restoration and the enhancement of environmental quality. This regulation helps WCSSs gain benefits in environmental protection. For example, NRL can maintain and protect natural water resources like rivers and lakes. RES contributes to soil conservation and ecological restoration. However, policy guides are not able to align with real applications. In practice, the completeness rate of "water resource protection and environmental repair" is only 53.42%. Therefore, there is still a gap between policy and implementation.

In addition, some WCSS projects are in sensitive areas that are vulnerable to ecological damage. In the construction process, land surface change, energy consumption, and carbon emissions lead to numerous environmental damages [42,48,49]. Moreover, tourist activities including accommodation and food service can aggravate air and water pollution and reduce the areas of wetlands and green space. A useful method to reduce these adverse impacts is control of the number of tourists [50]. However, some WCSS projects are not inclined to control the number since such control leads to a decrease in revenue. Overcrowding, especially during peak tourist seasons, tends to exceed the maximum capacity of the WCSS, which causes an irreversible change in the environment. Therefore, such extensive tourism development has adverse effects on environmental protection.

Table 4. The possible damage by WCSSs to the ecological environment.

Category	Components of Damage
Natural resources	• Groundwater depletion • Exhaustion of natural resources caused by tourism • Increased risk of fire • Increased energy consumption and waste discharge • Increased CO_2 emission
Population structure of animal and vegetation	• Damage to breeding habits • Hunting • Hindering animal migration • Damage caused by picking plants • Forest degradation by constructing facilities • Damage by trampling
Land surface	• Soil erosion • Increased the risk of natural hazards • Damage on geological characteristics • Erosion of the river bank and coastline • Geomorphological changes
Landscape pollution	• Loss of biodiversity • Landscape fragmentation • Increased the ecological risk • Low aesthetic values

6. Conclusions and Discussion

Due to good aquatic and ecological environments, beautiful landscapes, and the profound culture and heritage of water conservation, the Chinese government launched a WCSS project proposal to promote their tourism function. The development of WCSSs can be divided into three stages according to the management and guidance of national and local governments: (1) the starting stage (1980–2000) shows the spontaneous development and exploration of WCSSs; (2) the standardisation stage (2001–2010) develops WCSS projects in practice with national approval and laws and regulation formation; and (3) the mature stage (2011–2025) aims to optimise WCSS development and to achieve the full economic, social, and environmental benefits of WCSSs. The annual number of newly constructed WCSS projects has increased from less than 20 in 2001 to almost 60 in 2016. Nevertheless, there are many problems requiring developers' attention.

6.1. The Problems in the Development of WCSSs

To guide the development of WCSSs, MWR issued the GWCSSP, consisting of 20 planning requirements, in 2010. Although these national-level regulations can promote the holistic and sustainable development of WCSS projects, most WCSS projects fail to completely follow it in practice due to the gap between high-level management and local conditions. Moreover, the development of WCSSs is unbalanced regarding regions and types. The majority of WCSS projects are in the eastern and central parts of China due to the developed economy in these areas. Similarly, NRL, RES, and URL projects occupy almost 90% of the total number of WCSSs, which is remarkably higher than the proportions (about 10% total) of WLD, IRA, and WSC projects.

In addition to the unequal distribution, WCSSs in practice have problems with education and culture promotion. It is considered that WCSSs can impart knowledge by illustrating the hydrologic theory in museums and identify the feasibility of water-related technologies through the implementation process. Unfortunately, these advantages are not able to gain enough attention since almost half of the existing WCSSs do not consider educational planning. Moreover, the homogenisation of planning and construction of commercial activities can earn profits in the short term, while it accelerates the loss of a culture-specific feature and, in turn, destroys cultural relics in the long run.

From the economic perspective, WCSSs can increase revenue through the development of the tertiary industry and decrease the unemployment rate by creating employment opportunities. However, a prerequisite to constructing a WCSS is a considerable amount of funding which puts financial pressure on local governments. Also, many existing WCSSs have weaknesses in marketing, which is a vital method to gain popularity, attract tourists, and increase revenue.

Regarding environmental aspects, since some WCSS projects are in sensitive and vulnerable areas, their construction can easily trigger damage to natural resources, damage to clusters of animals and plants, land surface erosion, and landscape pollution. Moreover, tourist activities lead to land surface change, energy consumption, carbon emissions, and ecological damage. Although controlling the number of tourists to avoid overcrowding is a useful strategy to reduce the damage, existing WCSSs are not inclined to do this as the increased number of tourists brings in a lot of revenue.

6.2. Suggestions for Planning and Management

(1) Strengthening Supervision and Fostering Balanced Development

The GWCSSP issued by WMR aims to regulate the planning and management of WCSSs, while the majority of existing WCSSs fail to follow this regulation. One of the reasons for this situation lies in a lack of supervision by relevant authorities. Since some requirements are challenging to satisfy and not able to create profits immediately, WCSSs have a fluid approach and select to ignore these requirements. Therefore, it is urgent to strengthen the supervision of policy implementation. This can be achieved by regarding the policy implementation as an assessment index or by using punishment to regulate the implementation process [50,51]. Since annual performance assessment is exceptionally vital for organisations or departments in China, considering policy implementation as an indicator can scale up deployment. If a WCSS cannot meet the requirements, punishment can then be enforced.

Furthermore, western areas of China have fewer WCSS projects than both the eastern and central regions. However, western areas also have their unique water culture, natural resources, and the market for water tourism. Therefore, it is suggested to quicken the pace for the development of WCSSs in western regions to close the spatial gap. Compared with the western region, the eastern and central areas which have a high density of WCSSs should focus on improving quality rather than expanding the number of projects.

(2) Promoting Education and Protecting Culture

Due to the lack of a science educational function in WCSSs, it is suggested to build education-related infrastructure and explore the uniqueness of culture, enhancing public education about water protection and water culture promotion. The building of education-related infrastructure can provide tourists with opportunities to gain water-related knowledge. For example, hydrographic museums can illustrate the planning, generation, and evolution of WCSSs, and enable the public to understand the application of hydraulic theories in the construction processes. Another strategy is preserving the uniqueness of culture by managing cultural activities. The public is commonly curious about distinctive cultures, which shows their high potential for commercial opportunities [52]. Running cultural activities can attract curious tourists, which could not only make contributions to preserving these precious legacies but also attract tourists and, in turn, increase government revenue.

(3) Distributing Funding and Enlarging Popularity

Proper funding distribution can alleviate the financial shortage for WCSSs in many areas. Although investment in some areas such as infrastructure is significant, it is also vital to invest in WCSSs that offer a superior return on investment from the development of the tertiary industry [38,53]. The government should, therefore, find a balance between assigning funding for WCSSs and other areas. Also, it is required to market WCSSs to gain popularity that can attract more tourists and increase revenue. The marketing can be the use of advertising through various media such as the Internet and TV, or the use of campaigns (such as ticket discounts) to increase tourist numbers.

(4) Controlling the Amount of Tourism and Avoiding Overexpansion

Human activities lead to numerous environmental issues including damaging natural resources, destroying clusters of animals and plants, land surface erosion, and landscape pollution. Although these issues cannot be avoided, careful planning can slow down the processes of damage [54]. Controlling the number of tourists, especially in peak periods, has the function of both lowering human impacts on environments and maintaining profits, which should be strongly encouraged [55,56]. Additionally, the overexpansion of WCSSs generates many problems due to the lack of experience. With this background, the priority should be to emphasise holistic planning that minimises adverse human effects. By doing this, the development of WCSSs will be more sustainable and comprehensive.

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