

## The impact of the water commonweal propaganda on citizens' water-saving behavior: the intermediary role of propaganda channels and forms – evidence from China

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### ABSTRACT

The water commonweal propaganda is an important measure to promote citizens' water resource conservation and water-saving behavior. Based on Amos 21.0, this paper adopts structural equation models, through variable extraction and path construction, to explore the mechanisms of how water commonweal propaganda influences citizens' water-saving behavior. The research investigates the case of China's water commonweal propaganda. The results show that: (1) when the same propaganda forms and channels are adopted, the impact of different water commonweal propaganda content on citizens' water-saving behavior is significantly different; (2) with the same water commonweal propaganda content, different propaganda forms and channels have different impacts on citizens' water-saving behavior. Therefore, selecting appropriate propaganda forms and channels for the water commonweal propaganda can significantly improve their impact on citizens' water-saving behaviors. The research aims to provide theoretical support and practical basis for China's follow-up water commonweal propaganda.

**Key words:** Propaganda channels, Propaganda forms, Structural equation model, Water commonweal propaganda, Water-saving behavior

### HIGHLIGHTS

- The water commonweal propaganda is an important measure to promote citizens' water resource conservation and water-saving behavior.
- This study conducted an empirical analysis based on the questionnaire and Amos 21.0.
- The water commonweal propaganda has a significantly positive impact, varied using different propaganda forms and channels.
- For various water commonweal propaganda content, if the government chooses appropriate propaganda forms and channels, its propaganda effect can be significantly improved and greatly promote citizens' water-saving behavior.

## 1. INTRODUCTION

Water is an essential natural resource for humankind. In 2019, the United Nations pointed out in the 'World Water Development Report' that by 2050, global water demand is expected to increase by 20–30% compared with today's total amount of water consumption. Under this background, there will be more than 2 billion people living in countries with severe water shortages, and about 4 billion people will suffer from severe water

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shortages for at least 1 month per year (Media Convergence, 2019). The Food and Agriculture Organization of the United Nations stated that: ‘Water scarcity has become one of the biggest challenges currently’, and ‘Water is the key for agricultural production and food security ... however, freshwater resources are declining at an alarming rate.’ Water shortage is one of the major global challenges that we are facing today. The protection and rational utilization of water resources is an urgent task for all countries around the world.

China’s water shortage situation is also increasingly alarming. According to statistics from the Ministry of Water Resources of the People’s Republic of China in 2018, the total amount of water resources in China was 274.25 billion m<sup>3</sup>, and the per capita water resources were only 1,971.8 m<sup>3</sup>. Moreover, due to the development of industry, agriculture, and urbanization, China’s annual growth rate of domestic water consumption has kept increasing. According to statistics in 2019, compared to the level of 2018, the total water consumption in the country increased by 570 million m<sup>3</sup>, of which industrial water consumption decreased by 4.41 billion m<sup>3</sup>, agricultural water consumption decreased by 1.09 billion m<sup>3</sup>, and domestic water and artificial ecological environment replenishment increased by 1.19 and 4.88 billion m<sup>3</sup>. The total amount of consumption has been continuously increasing yearly. As one of the world’s severely water-scarce countries, China urgently needs to promote its citizens’ water-saving behavior and strengthen its water resources management practices to achieve sustainable development goals.

In addition to economic tools, to promote citizens’ water-saving behavior, the main measures that most countries adopt include water commonweal propaganda and education. People’s behaviors are generally locked in their daily social practices, and it is challenging to change their inherent water-using habit. The existing research reveals that both economic and non-economic factors can affect people’s water-using behavior (Yue *et al.*, 2020). Economic factors, especially water prices such as the differentiated water prices based on the different levels of amount of water, have been used and have a direct effect on water-using behavior (Liao *et al.*, 2016). However, the water prices in China are very low and are not easy to be changed at the moment, resulting in its limited impact on citizens’ water-saving behavior (Ma & Zhang, 2015). Some scholars have recognized that purely relying on economic tools to promote people to save water is not sufficient (Yue, 2014), and economic and non-economic factors need to be considered complementarily (Mizobuchi & Takeuchi, 2013). With the development of behavioral theory and psychology, research on non-economic factors has gradually expanded from demographic indicators to individual psychological characteristics and then to external situational factors. For example, Australia employs various media to publicize and educate citizens to enhance their awareness of water conservation (Wang *et al.*, 2006). In the light of the theory of planned behavior, if the actors have strong subjective norms, they will also have strong behavioral intentions (Ajzen & Driver, 1991). Since information intervention strategies have a positive impact on citizens’ energy-saving behaviors (Mi *et al.*, 2016; Yang *et al.*, 2020b), and the strengthening of propaganda and education can significantly improve the environmental awareness of Chinese urban residents, thereby effectively reducing household energy consumption (Yang *et al.*, 2016). As the water commonweal propaganda is a crucial pre-information intervention strategy, it will play an essential positive role in promoting citizens’ energy-saving behavior (Mehdi & Jerrod, 2020). Moreover, implementing targeted intervention policies for specific populations can significantly improve their water-saving capabilities (Han *et al.*, 2013). When citizens learned water-related knowledge and gradually formed efficient water resources management behavior and increased their water ecology protection awareness, they will take action to solve various water-related problems and improve their water-saving behaviors (Tian, 2019).

In 1993, the United Nations designated March 22 as ‘World Water Day.’ Since then, the United Nations has adopted extensive propaganda and education channels to raise public’s water-saving awareness and carried out various activities every year around the world to promote comprehensive water resources management practice so that to solve the increasingly severe water shortage problem. In 1988, China designated July 1–7 as ‘China

Water Week.’ As the themes of World Water Day and China Water Week are the same, and to make it more influential, the time of ‘China Water Week’ was changed to March 22–28 since 1994. The theme of ‘World Water Day’ in 2021 was ‘Valuing Water’, while that of ‘China’s Water Week’ was ‘In-depth implementation of the new development concept and promote the intensive and safe utilization of water resources’. So far, China has committed itself to employ the water commonweal propaganda and expanded a variety of propaganda forms and channels to promote citizens’ water-saving behaviors. For example, on the ‘World Water Day’ and during ‘China Water Week’, the water conservancy departments of all provinces and cities launched the water commonweal propaganda activities. Volunteers disseminate water commonweal brochure, promote daily water-saving tips, and explain water-related knowledge to citizens. In addition, many provinces and cities have successively established their own water regimen education bases, water ecological museums and wetland parks. They also opened public media accounts such as Weibo and WeChat to channel the information to the public. The water conservancy department also carries out various water commonweal activities in conjunction with the National Science Popularization Day and Science and Technology Activity Week and conducts Internet broadcasts to promote the water commonweal propaganda. Furthermore, China has integrated water conservation into kindergarten, primary and secondary education, and has published the water commonweal propaganda through traditional media such as radio, television, newspapers, and the Internet regularly, so that to efficiently promoting citizens’ water-saving behaviors. Finally, some water-related activities and competitions are often carried out in various provinces and cities, such as water knowledge contests, river and lake poetry recitations, river-related audio and video contests, and photo contests, to promote citizens’ awareness of the importance of water conservation.

To sum up, the current research predominantly focuses on the water commonweal propaganda content, propaganda forms, and channels specifically, instead of incorporating the three into one framework to study the overall impacts of water commonweal propaganda. What is the mechanism of the water commonweal propaganda’s impact on the improvement of citizen’s water-saving behavior? If different propaganda content is delivered through the same propaganda form and channel, will the propaganda effect be the same? If different propaganda forms and channels are employed for the same content, what is the difference in the propaganda effect? Can the three be combined and used more efficiently so that to significantly improve the effectiveness of the water commonweal propaganda? These have not been explored in the current research.

This paper obtains the original data through questionnaires and involves many variables, and it is appropriate to use the structural equation to study the internal influence mechanism through the path hypothesis. First of all, we select variables and design a questionnaire, and second, a structural equation model is constructed to conduct empirical research based on Amos 21.0. Structural equation models can establish, estimate, and test causality. The model contains explicit observable variables and latent variables that cannot be directly observed. It can clearly analyze the effectiveness of individual indicators on the overall impact and the interrelationship among individual indicators, process multiple dependent variables simultaneously, and compare and evaluate different theoretical models. Therefore, on the basis of the interest, validity, and continuous of propaganda form, as well as the convenience, credibility, and timeliness of propaganda channels, this paper explores the impact mechanism of water commonweal propaganda on water-saving behavior through different propaganda forms and channels. It is hoped that this study can fill up the gaps identified above and provide further suggestions to improve the future water commonweal propaganda.

The structure of the paper is as follows: Section 1 is the introduction; Section 2 extracts the independent variables of the water commonweal propaganda on water-saving behavior, as well as intermediary variables. Section 3 constructs a path model, makes assumptions, and designs a questionnaire; Section 4 conducts the reliability and validity test that presents analysis; and Section 5 discusses the impact of the water commonweal propaganda on water-saving behavior and gives policy recommendations.

## 2. MATERIALS AND METHODS

### 2.1. Independent variables

First, it discusses how to select the indicators to measure the water commonweal propaganda. There are several studies on this topic, and most of them are focused on its propaganda content. Since water-saving research is a branch of energy-saving research, the literature review also extends to the energy-saving field. Some scholars suggest that a variety of water-related cultural content should be nurtured (Luo & Wang, 2014) to meet the growing cultural needs of the people (Yang & Luo, 2015). Moreover, water-related culture education is one of the essential approaches to construct water ecological civilization (Chen *et al.*, 2019). It is necessary to alter people's routine and mobilize long-term intensive education to cultivate citizen's water-saving cultural consciousness. It has been discovered that water-related laws and regulations are an essential part of the water commonweal propaganda content. Water-related knowledge should be combined with water laws to improve the effectiveness of the water commonweal propaganda (Luo *et al.*, 2014). Studies have also found that water-saving (energy) behaviors are subject to water-saving (energy) policies (Cong *et al.*, 2018; Hong *et al.*, 2019), social norms (Nolan *et al.*, 2008; Bian *et al.*, 2019), behaviors, subjective norms, perceptual behavior control water-saving status (Zhang *et al.*, 2020), and other factors (Zhang *et al.*, 2018). Furthermore, it has been proved that with the appropriate policy guidance, residents' energy-saving willingness and behavior can be significantly improved, i.e., the implementation of energy-saving policies can greatly encourage residents to nurture their energy-saving behaviors (Ting *et al.*, 2020).

The status related to water resources is also included in the water commonweal propaganda. For example, expanding citizens' knowledge about water resources (Xu *et al.*, 2020) and making them being aware of climate change on water supply can help nurture their water-saving behavior (Torres-Bagur *et al.*, 2020). It has been found that the individual's subjective value and energy knowledge reserves also greatly shape family's energy-saving behavior (Zhang *et al.*, 2018). In addition, some studies have employed a quantitative method to investigate how does water resources contribute to economic production from the perspective of energy analysis (Jiang, 2010). There are also some studies involving water ecology, such as water ecological civilization city (Pan & Hu, 2020), water ecological safety evaluation (Dai *et al.*, 2021), water ecological civilization construction (Qiu & Zhou, 2020), and water ecological protection (Yang *et al.*, 2020a). Water-related technology has also been explored simultaneously. For example, the use of existing technologies can reduce the current residential energy consumption by 25% (Gardner & Stern, 2008), and some have investigated these critical technologies for urban water-saving (Wang *et al.*, 2020).

Meanwhile, the application of water-related technologies in the landscape design of agricultural carnivals (An *et al.*, 2020) has greatly increased public interest in water resources. Of course, some scholars and water commonweal propaganda also consider the demonstration role of water-saving figures and areas, such as the promotion of outstanding water conservancy workers and water-saving cities (Du, 2020), as well as the analysis of water-saving influencing factors of residents in a specific city (Zhang *et al.*, 2018). Finally, Wang *et al.* (2019) have studied the main influencing factors of residents' water-saving behavior based on ground theory, and the results showed that management behaviors, persuasive behaviors, consumer behaviors, and legal behaviors of the water ecological environment are the crucial factors that affect residents' water-saving behavior. In other words, solving the global water crisis requires not only water-related technological progress but also raising the public's water-cultural awareness, which also demonstrates the importance and the necessity of water commonweal propaganda.

After sorting out the content of the water commonweal propaganda, we select representative research papers and list their keywords, see Table 1.

**Table 1.** | Keyword extracted from the research on water commonweal propaganda.

Scholars	Keywords from their research	Keywords extracted
Zheng (2020)	Water resources, current problem, Countermeasure	Water status
Yang <i>et al.</i> (2020a)	Soil and water conservation, Water ecological protection, ecosystem, water and soil loss	
Torres-Bagur <i>et al.</i> (2020)	Good water practices, tourist accommodation, water scarcity.	Water culture
Zhang & Zhang (2013)	Water-related culture, propaganda channels	
Wang (2014)	Water-related culture propagation, water-related culture education, propaganda channels	
Chen <i>et al.</i> (2019)	Water-related culture education, water ecological civilization, propagation bottleneck	
Alicia <i>et al.</i> (2021)	New water culture, validation, questionnaire	Water policy
Cong <i>et al.</i> (2018)	Water-saving policy, water-saving behavior	
Luo <i>et al.</i> (2014)	Water knowledge lecture, water-related policy	
Hong <i>et al.</i> (2019)	Energy-saving behavior, government subsidy policy	
Ting (2020)	Energy-saving behavior, policy situation, multi-agent simulation	
Jiang (2010)	Water resources, economic production, contribution value, contribution rate, energy analysis;	Water contribution
An <i>et al.</i> (2020)	Water-related technology, creativity, landscape design	Water demonstration
Du (2020)	Water-saving, urban, construction research	
Pan & Hu (2020)	Water ecological civilization, urban construction	
Luo <i>et al.</i> (2020)	Water-saving community construction, water-saving society	

In summary, the water commonweal propaganda mainly focuses on five aspects: policies, culture, scientific and technological contribution, typical demonstrations, and water status. Therefore, we set indicators of the water commonweal propaganda into the following five categories and expand their connotation, as shown in [Table 2](#).

## 2.2. Mediating variables

There are several researches on the propaganda forms and channels of the water commonweal propaganda. Because of the integration and complexity of the propaganda forms and channels nowadays, this paper focuses on their development trends. The propaganda forms of China's water commonweal propaganda show a diversified development trend from the early stages only focusing on simple text, picture, audio, video, model, and behavioral activities to the current large-scale promotional film or audio and video. The target population has gradually expanded from students to the wide public. For example, some colleges and universities offered water-related cultural courses for the students. Such courses have crucial guidance and reference significance for Chinese water-related cultural education (Rao, 2010). Meanwhile, water conservancy scenic spots are proven to be one of the important means to spread water-related culture (Zhang & Zhang, 2013). Various forms of involvement of public are suggested to launch to enhance the impact of the water commonweal propaganda, for example, setting up volunteer service team, carrying out a series of activities, preparing publicity manual, and calling on the public to participate in water-saving actions (Yin *et al.*, 2019).

Meanwhile, the propaganda channels for water commonweal propaganda are increasingly expanding, which has gradually expanded from the early newspapers, books, radio, television, etc., to include WeChat group, Baidu Post Bar, WeChat public account, TikTok, and other news media. These online and offline interactions

**Table 2.** | Indicators of water commonweal propaganda content.

First-level indicator	Secondary indicators	Connotation
Water commonweal propaganda content	Water status	Water status involves basic and real-time water status. Basic water status refers to the overall water status globally, including issues such as water history, reality, and development trends. The real-time water status refers to the frequent floods and drought crises that occur every year.
	Water policy	Water policy refers to water-related laws and regulations and a series of active principles, work steps, and specific measures implemented by the governments based on the water status in a certain period.
	Water culture	Water culture refers to the sum of material heritage and spiritual achievements related to water, such as intellectual wisdom, humanistic works, and custom beliefs.
	Water contribution	Water contribution refers to the economic contribution, social contribution, ecological contribution, and scientific and technological contribution that water resources bring to human. It involves the benefits and profit of water resources to the ecological environment, technological development, industrial and agricultural production, and social progress.
	Water demonstration	Water demonstration mainly refers to the current water-saving cities, water-saving communities, well-known water conservancy workers, and water-saving models. It also includes large-scale water conservancy projects such as Dujiangyan, Three Gorges Dam, and Xiaolangdi and water-related education bases distributed in various areas.

have powerfully attracted the attention of the public and have played a positive role in promoting citizens' water-saving behavior. Studies have shown that to realize the 'addition' to 'combination' of all media, it is necessary to explore the advantages of various carriers in the era and build an all-around propaganda pattern through innovating the interaction channels and improving the content quality (Jin, 2020). As one of the traditional media, the TV should also actively devote itself to deliver the practice of integrated development, such as integrating communication resources, opening up channel integration, and spreading innovative paths (Kong, 2020).

### 2.2.1. Propaganda forms

Although propaganda forms are in a trend of integrated development, and there is no clear definition among each other, this paper conducts an independent verification for each propaganda form to obtain a valuable reference. We selected six common propaganda forms, briefly defined them, and presented in Table 3.

### 2.2.2. Propaganda channels

There are various propaganda channels that can be adopted. According to their distinctive features and functions, this paper selects six common propaganda channels which have been widely used in the water commonweal propaganda in China, as shown in Table 4.

## 2.3. Path model and assumptions

### 2.3.1. Construction of the path model

After reviewing the relevant literature, this paper clearly defines the concept, scope, and context of the water commonweal propaganda. While considering its time, location, and audience, we have constructed a conceptual

**Table 3.** | Common propaganda forms in the water commonweal propaganda.

Propaganda form	Definition
Text	The text refers to the written word about water resources. The water commonweal propaganda mainly refers to water commonweal information that can be read in various media, such as policies, regulations, important speeches, and others.
Image	Image refers to pictures, photos, rubbings, etc., and here mainly refers to visual images or paintings related to water commonweal propaganda.
Audio	Audio refers to the various sounds that can be heard by humans. We define it as the sound information that appears on various media related to water commonweal propaganda.
Video	Video usually refers to various dynamic images, which we define as visual information in various media related to water commonweal propaganda.
Paradigm	Paradigm generally refers to actual models. In the water commonweal propaganda, we define it as various appliances and physical models and demonstrators such as famous water conservancy engineers or water-saving Internet celebrities, etc.
Activity	Activity refers to a series of specific actions that promote water commonweal propaganda through human participation and interaction, such as water-related lectures, activities, conferences, etc.

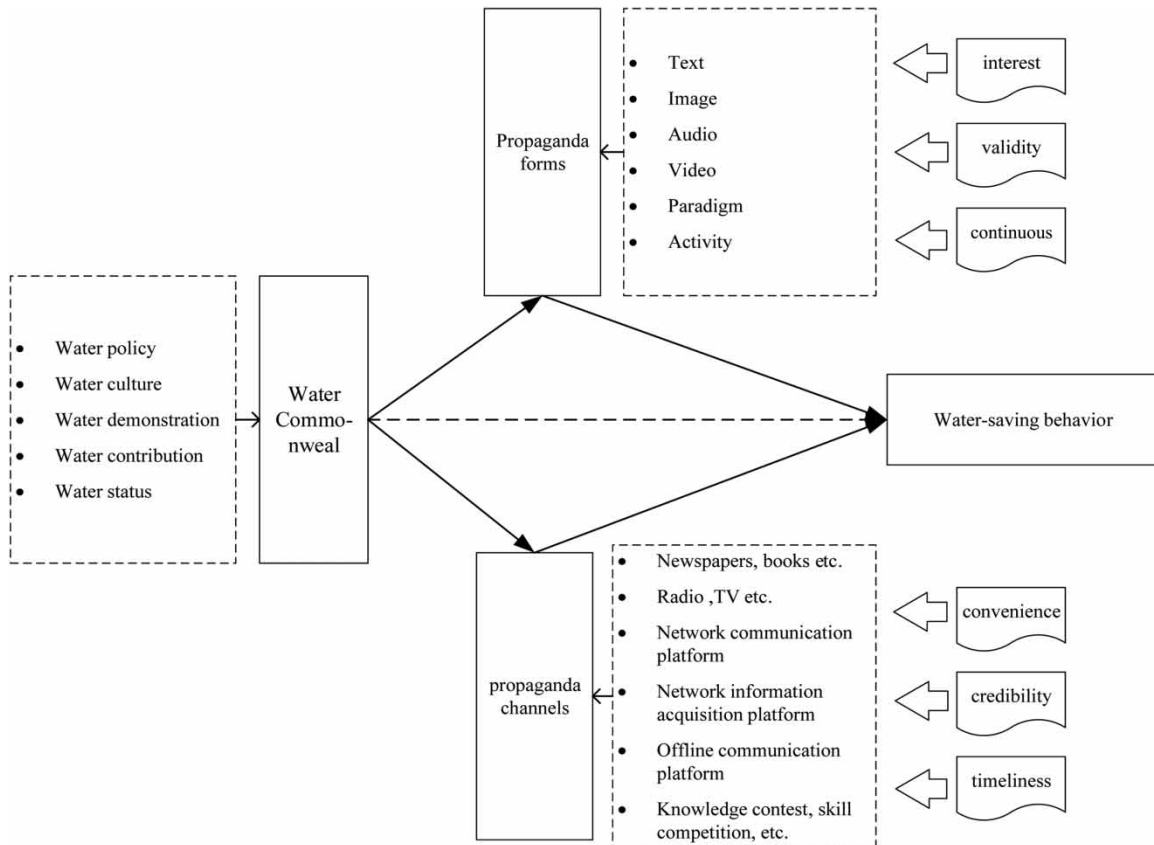
**Table 4.** | Widely used water commonweal propaganda channels in China.

Channel types	Representative channels
Traditional paper channel	Newspapers, books, etc.
Traditional broadcasting channel	Radio, TV, etc.
New information exchange channel	Network communication platform (WeChat group, Baidu Tieba, etc.)
New information acquisition channel	Network information acquisition platform (Baidu Baike, WeChat Official Account, TikTok, etc.)
Traditional information exchange channel	Offline communication platform (symposiums, seminars, etc.)
Traditional information acquisition channel	Knowledge contest, skill competition, etc.

model of ‘The path model of the impact of the water commonweal propaganda on citizens’ water-saving behavior’, as shown in [Figure 1](#).

### 2.3.2. Assumption

We adopt the symbol  $X$  to represent the specific content of the water commonweal propaganda (the independent variable). Therefore, water policy, water culture, water contribution, water demonstration, and water status are its sub-variables represented by  $X^1$ ,  $X^2$ ,  $X^3$ ,  $X^4$ , and  $X^5$ , respectively. The propaganda form, which is one of the intermediary variables, is denoted by  $A$ . Text, image, audio, video, activity, and paradigm are its sub-variables, so they can be denoted by  $A^1$ ,  $A^2$ ,  $A^3$ ,  $A^4$ ,  $A^5$ , and  $A^6$ , respectively. Similarly, propaganda channel is denoted by  $B$ . Its sub-variables, such as traditional paper channel (newspapers, books, etc.), traditional broadcasting channel (radio, TV, etc.), network communication platform (WeChat group, Baidu Tieba, etc.), network information acquisition platform (Baidu Baike, WeChat official account, TikTok, etc.), offline communication platform (symposiums, seminars, etc.), knowledge contest, and skill competition are  $B^1$ ,  $B^2$ ,  $B^3$ ,  $B^4$ ,  $B^5$ , and  $B^6$ , respectively. Finally,  $Y$



**Fig. 1.** | Path model of the impact of the water commonweal propaganda on citizens' water-saving behavior.

is adopted to denote water-saving behavior (dependent variable). Based on the variable setting and path model, surely, the water commonweal propaganda content has an impact on citizens' water-saving behavior, and the impact occurs through propaganda forms and channels. Then, we obtain Hypotheses 1 and 2:

'Hypothesis 1: the water commonweal propaganda (X) has a positive and significant impact on citizens' water-saving behavior (Y) through the propaganda form (A).

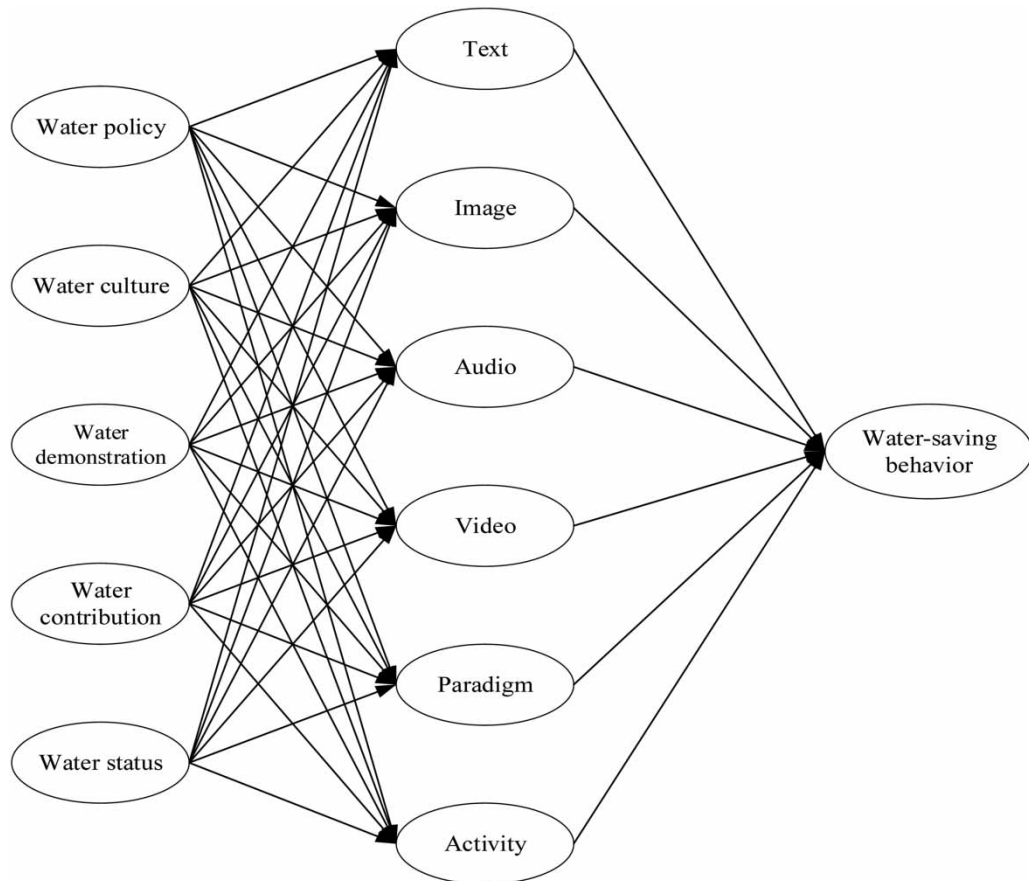
Hypothesis 2: the water commonweal propaganda (X) has a positive and significant impact on citizens' water-saving behavior (Y) through the propaganda channel (B).'

Since the water commonweal propaganda contains five sub-variables, and propaganda form and channel contain 6 sub-variables, respectively, when Hypotheses 1 and 2 are fully expanded, we will get all of their sub-hypotheses, as shown in Figures 2 and 3.

## 2.4. Questionnaire design

One of the most used methods in behavioral research is the questionnaire. In this study, the main body of the questionnaire consists of three parts. The first part is to investigate the importance of the water commonweal propaganda content on citizens' water-saving behavior, including water policy (POL), water culture (CUL), water

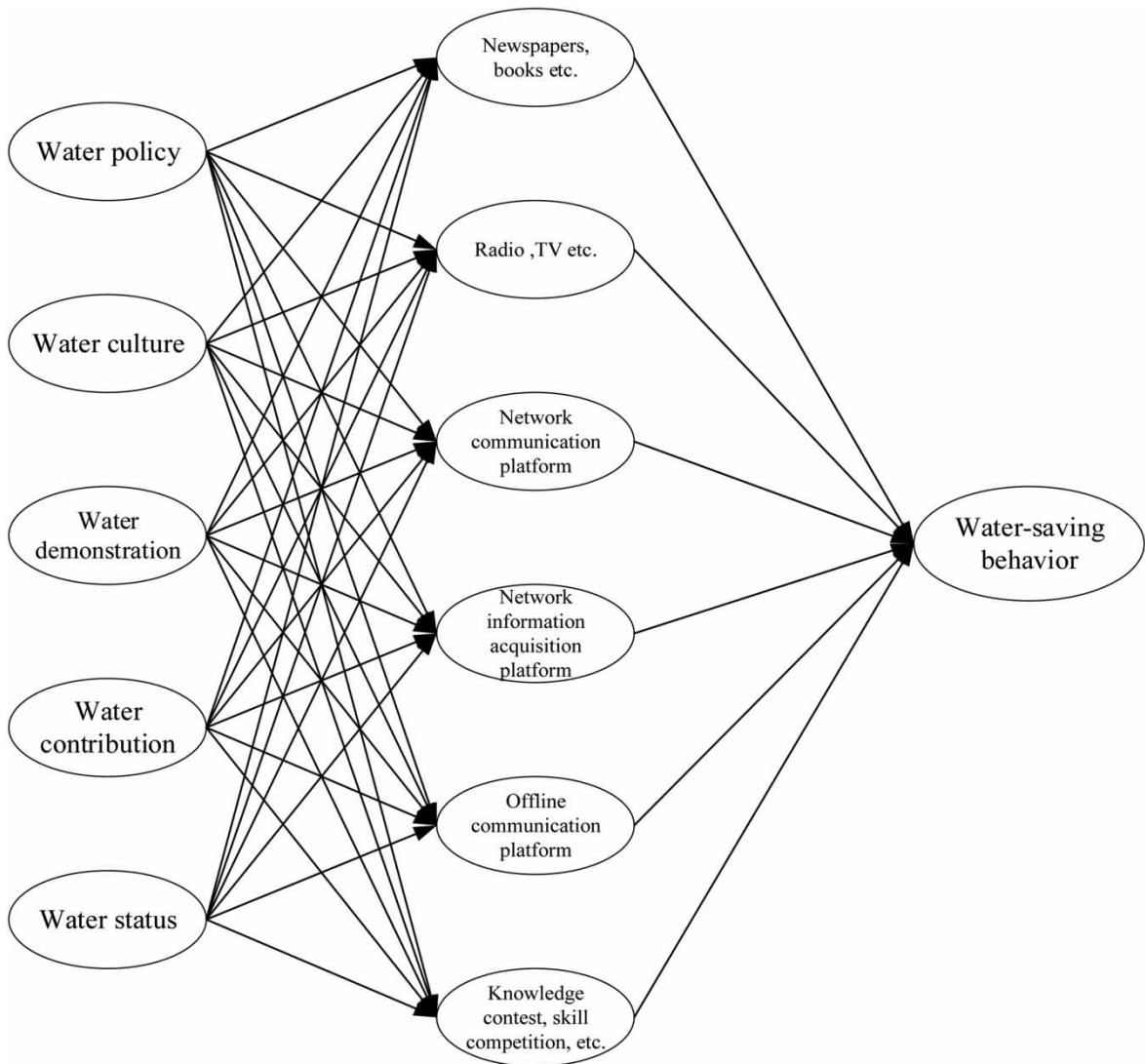




**Fig. 2.** | All sub-hypotheses of Hypothesis 1.

demonstration (DEM), water contribution (CON), and water status (REG). According to the above literature review, we have set four test items on the water policy (POL), water culture (CUL), and water contribution (CON), respectively. In addition, we also set six items on water demonstration (DEM) and five items on water status (REG). The specific content of each variable is shown in Table 5. The second part evaluates the characteristics of propaganda forms and channels. The third part is about citizens' water-saving behaviors. Three parts are scored using the Likert 5-level scale.

Due to the ongoing COVID-19 pandemic, we distributed the questionnaires through the online tool, questionnaire star, and received 648 questionnaires. After excluding the invalid questionnaires, there are 592 valid questionnaires, and the effective rate was 91.36%. For the gender structures of respondents, there was a relatively balanced male-female ratio. These respondents are geographically widely distributed, covering China's five regions: East China, South China, West China, Central China, and North China. The survey was divided into five categories according to the respondents' age: 6–17, 18–35, 36–45, 46–59, and over 60-year-olds, the results showed that respondents were mostly aged between 18–35 and 36–45 years old, accounting for 75.34 and 17.90%, respectively. The education levels mainly are undergraduates (including college students), accounting for 83.28%. The occupations of the respondents are mostly students, people from enterprises, and public institutes, accounting for 15.87, 62.16, and 10.14%, respectively. The average monthly income of the respondents



**Fig. 3.** | All sub-hypotheses of Hypothesis 2.

can be divided into four categories: 5,000–10,000, 10,000–20,000, 20,000–50,000, and over 50,000 yuan, and the results showed that their average monthly income were mostly between 5,000 and 10,000; 10,000 and 20,000 yuan; and 20,000 and 50,000 yuan, accounting for 28.03, 41.72, and 19.43, respectively.

### 3. RESULTS

#### 3.1. Reliability and validity test

According to literature analysis, the definition of water-saving behavior is mainly based on ‘Research on Citizens’ Water Literacy Theory and Evaluation Methods’ (Tian, 2019). The operational definition of variables is shown in Table 6.

**Table 5.** | Specific item content of each variable.

Variable	Item content
Water policy (POL)	<p>‘Water Law of the People’s Republic of China’, ‘Law of the People’s Republic of China on Prevention and Control of Water Pollution’, ‘Law of the People’s Republic of China on Water and Soil Conservation’, ‘Flood Control Law of the People’s Republic of China’</p> <p>Rules and regulations issued by the water conservancy departments in various provinces and cities</p> <p>The major strategy proposed by the Ministry of Water Resources of the People’s Republic of China on water conservation and water control in a certain period</p> <p>The 12,314 supervision and reporting service platform opened by the Ministry of Water Resources of the People’s Republic of China</p>
Water culture (CUL)	<p>The water-related culture and achievement in the history of China, such as Dayu’s thoughts on water control and Dujiangyan irrigation system built by Li Bing</p> <p>Modern water prevention and control ideas, such as engineering flood control and water-saving technology</p> <p>Water-related festivals and customs, such as the Water Festival of the Dai people, the dragon boat festival of the Miao people, and the water worship customs of the Zhuang people</p> <p>Water-related artworks, such as paintings, poems, films, and music</p>
Water demonstration (DEM)	<p>Advanced experience and selection criteria of water-saving cities and communities</p> <p>Water-saving technology, pipeline renovation methods, and selection criteria of water-saving enterprises</p> <p>Major water-related research projects undertaken by scientific research institutions</p> <p>Important water conservancy projects or water regimen education bases, such as the Three Gorges Dam, Red flag canal, and Water Conservancy Museum</p> <p>Excellent experience of outstanding water conservation representatives and water conservancy workers</p> <p>A public welfare organization or public welfare activity with the theme of ‘saving and protecting water and loving water’</p>
Water contribution (CON)	<p>Scientific and technological contribution such as knowledge innovation and technological breakthroughs brought by the utilization and development of water resources</p> <p>The social contribution of water conservancy projects to the stable development of society and people’s lives</p> <p>The economic contribution of water conservancy projects to promote related industries</p> <p>Ecological contributions such as animal and plant protection, environmental improvement, and ecological optimization brought by water conservancy projects and wetland parks.</p>
Water status (REG)	<p>The basic water regime that the per capita amount of freshwater resources in China is only one-fourth of the world average</p> <p>The basic water regime with the extremely uneven temporal and spatial distribution of precipitation and frequent floods and droughts</p> <p>Real-time water regime such as the continuous growth of water consumption and the prominent contradiction between water supply and demand</p> <p>Real-time water regime such as water ecological damage and frequent water environmental pollution incidents</p> <p>Real-time water regime for sudden natural disasters such as droughts and floods</p>

1. *Reliability test*: Cronbach’s  $\alpha$  is often used to measure the reliability of questionnaires. If it is more significant than 0.6, it is considered to have passed the test. In this study, the value of Cronbach’s  $\alpha$  of the water commonweal propaganda content is 0.848, that of the propaganda form is 0.846, that of the propaganda channel is 0.806, and that of the water-saving behavior is 0.812.

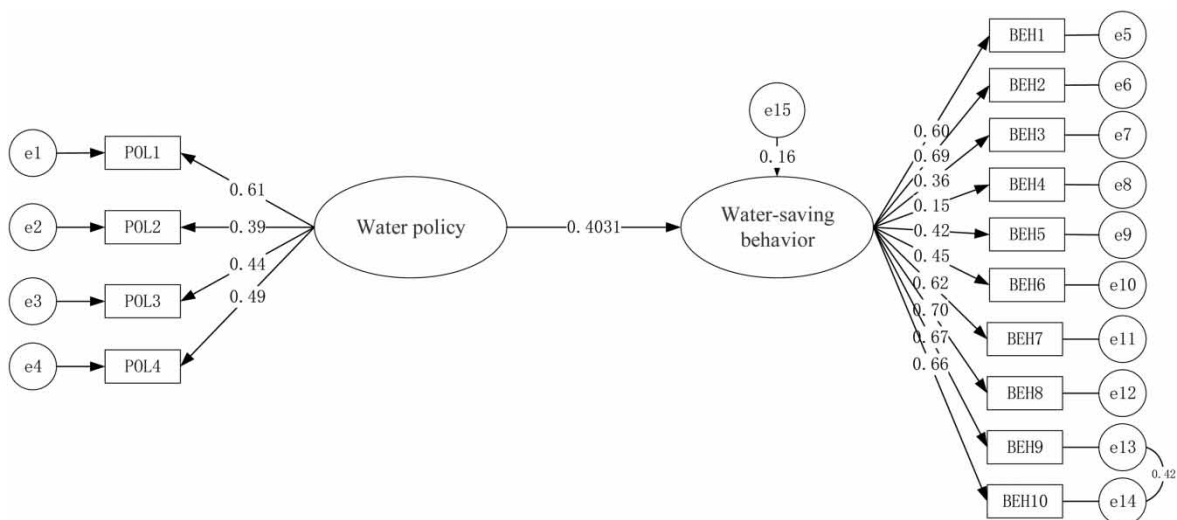
**Table 6.** | Operational definition of variables.

Type	Variable	Operational definition	
Dependent variable	Water-saving behavior		
Mediating variable	Propaganda form	Interest	Interest refers to the characteristics of the propaganda form that is full of interest and meaning that attracts the audience.
		Effectiveness	Effectiveness refers to the degree of completion of propaganda activities and the degree of achievement of propaganda results.
		Continuous	Sustainability refers to a process or state that can be maintained for a long time.
	Propaganda channel	Convenience	Convenience refers to the degree of convenience and speed with which the audience can access the propaganda content.
		Credibility	Reliability is the degree to which people or things can be trusted.
	Timeliness	Timeliness refers to the period of the social effect produced by the propaganda content.	

2. *Validity test:* Validity refers to the effectiveness of the measurement, that is, the more consistent the measurement results and the investigation content, the higher the validity; otherwise, the lower the validity. After importing all items into SPSS21.0 for KMO and Bartlett’s sphericity test, we get the following data: the KMO value is 0.893 (greater than 0.8, less than 0.9), the  $\chi^2$  statistic of Bartlett’s sphericity test is 14,730.478, and the Sig value is 0.000 (<0.05), indicating that there is a correlation between the variables.

### 3.2. Analysis of the mediation effects

The water commonweal propaganda includes five parts: water policy, water culture, water demonstration, water contribution, and water status. First, we construct a structural equation model of the impact of water policy on water-saving behavior, as shown in Figure 4. The constructed equation includes two measurement models and one structural



**Fig. 4.** | Structural equation model of the impact of water policy on water-saving behavior.

model (Wen *et al.*, 2004). Water policy is an exogenous variable, and water-saving behavior is an endogenous variable. The related paths of  $e_{15}$  and  $e_{17}$  are added to the model; the reason is that there is a considerable MI value between the two.

Theoretically speaking, the item “When someone around you or a company is found to have water violations, report to the relevant department” and the item “When the water administrative supervision and law enforcement department is found to be inadequate”, because “report to the relevant department” indicates that whether a company or an individual violates regulations is subject to the strict degree of supervision. There is a correlation between the two. Therefore, the relevant path of the residuals of BEH8 and BEH10 is added, as shown in Figure 4.

Fit the model by the least squares method to obtain its leading parameter indicators, as shown in Table 7.

It can be seen from Table 6 that all the indicators are in line with the reference value, indicating that the model fits well and can be further studied. Based on that the main effect passed the test, the intermediary variables are added, and the structural equation model of water policy–text–water-saving behavior is constructed, as shown in Figure 5.

Fit this model by the least squares method to obtain its leading parameter indicators, as shown in Table 8.

It can be seen from Table 8 that the value of the fitting indicator CMIN/DF is 2.754, which is lower than 3; the RMR and RMSAE values that represent the residuals and errors are both less than 0.08; and the values of GFI and AGFI are basically up to the standard, indicating that the model fits well and can be further studied.

The *P*-value of the influence path of the water policy on text, text on the water-saving behavior, and the water policy on the water-saving behavior all meet the requirement of less than 0.05. The standardized estimated values are all significantly positive, indicating that the second step of the mediation effect test is established.

Since the construction and verification process of the structural equation model of water culture, water demonstration, water contribution, and water status on water-saving behavior through propaganda forms and channels are the same as that of water policy on water-saving behavior, there is no need to repeat them here.

### 3.3. Path analysis

The water commonweal propaganda content includes five items: water policy, water culture, water demonstration, water contribution, and water status, all of which have a significant impact on water-saving behavior. The test results of the overall model hypotheses are shown in Table 9.

To explore the mechanism of how the water commonweal propaganda influences water-saving behavior through different propaganda forms and channels, this study constructed a structural equation model and tested the mediating effect of propaganda forms and channels. We select the results with a significant mediation effect, as shown in Table 10.

Based on the above test results, we obtain the influence model of the water commonweal propaganda on citizens' water-saving behavior on the basis of the mediating effect of propaganda forms and channels. The dotted

**Table 7.** | Fitted model of the impact of water policy on water-saving behavior.

Indicator	CMIN/DF	GFI	AGFI	RMR	RMSEA	CFI	IFI
Value	3.328	0.938	0.914	0.044	0.063	0.904	0.905
Reference value	1–3 (the loose value is five)	>0.90	>0.90	<0.05	<0.05 (the loose value is 0.08)	>0.90	>0.90
Judgement result	Acceptable	Fit	Fit	Fit	Acceptable	Fit	Fit

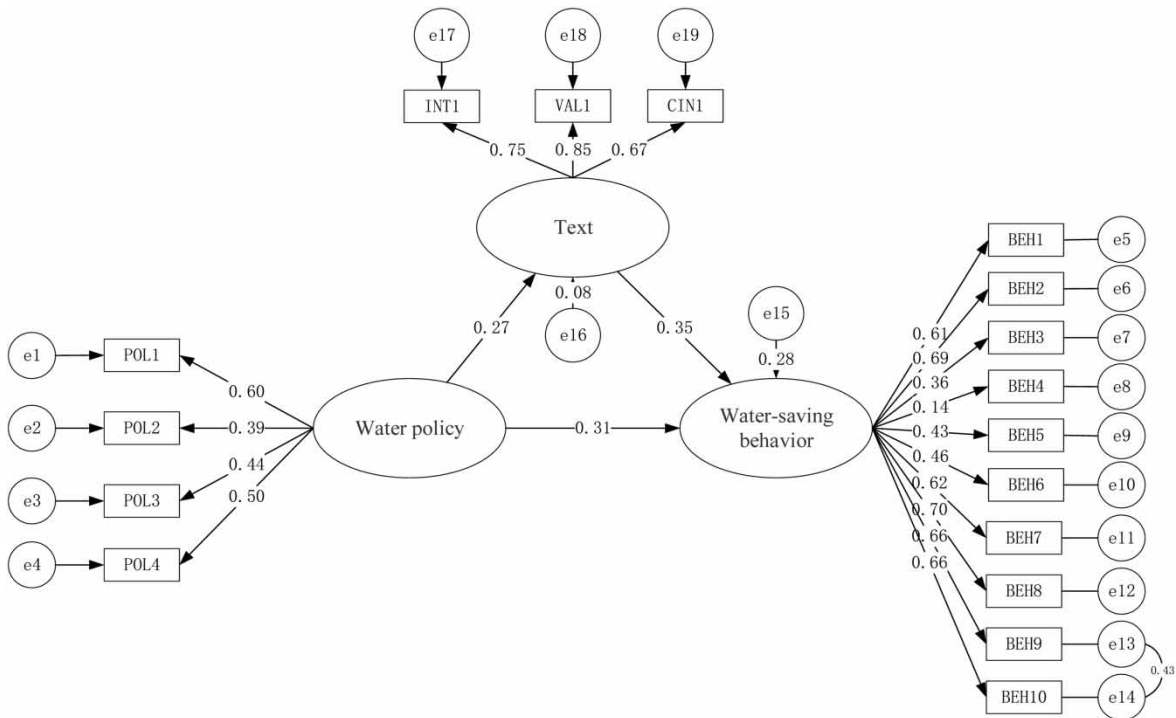


Fig. 5. | Structural equation model of water policy–text–water-saving behavior.

Table 8. | Fitted model of the impact of water policy–text–water-saving behavior.

Indicator	CMIN/DF	GFI	AGFI	RMR	RMSEA	CFI	IFI
Value	2.754	0.935	0.914	0.043	0.054	0.919	0.92
Reference value	1–3 (the loose value is 5)	>0.90	>0.90	<0.05	<0.05 (the loose value is 0.08)	>0.90	>0.90
Judgement result	Fit	Fit	Fit	Fit	Fit	Fit	Fit

Table 9. | Test results of overall model hypotheses.

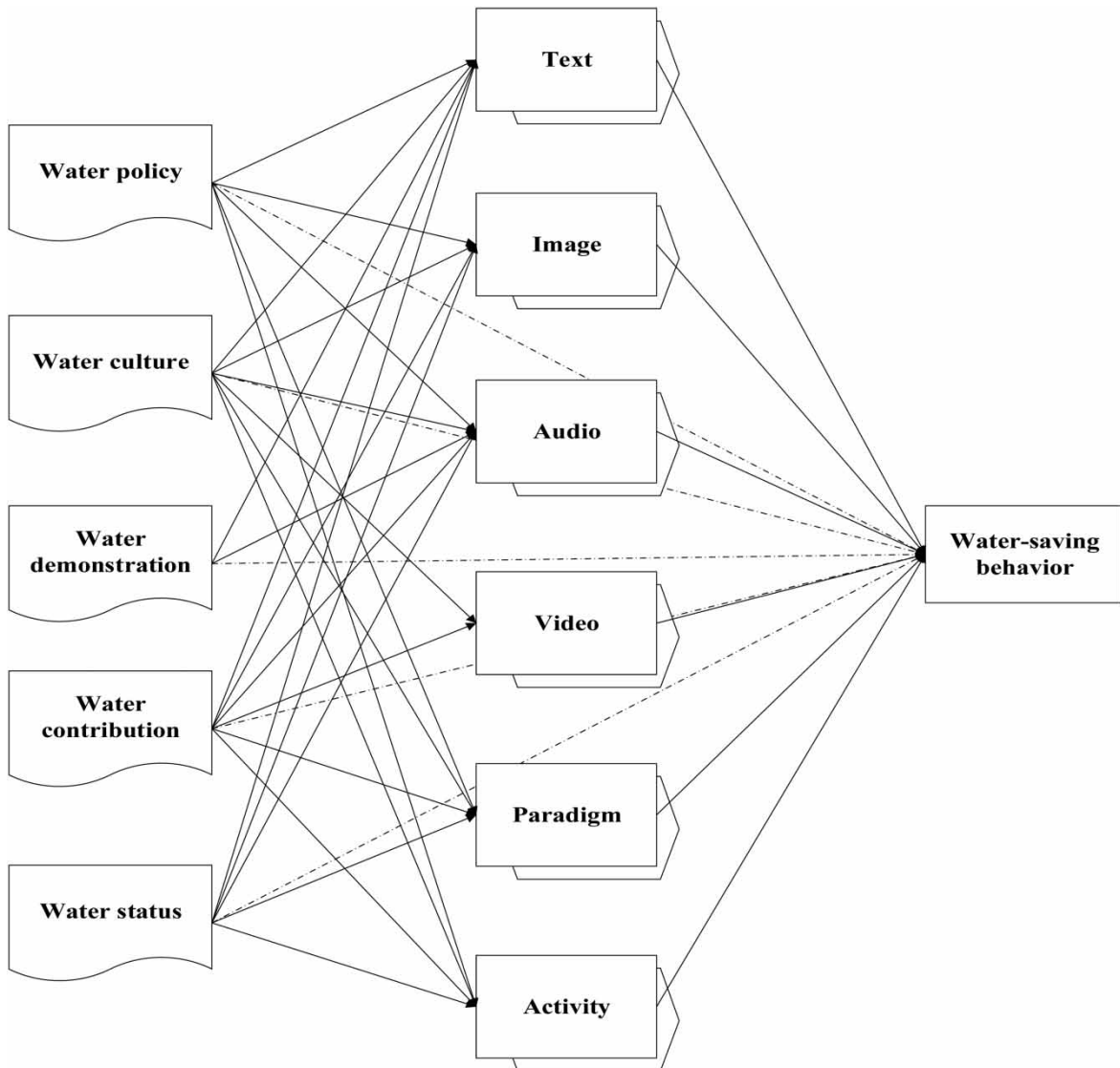
	Standardized regression coefficient	P	Accept/reject
Water policy → water-saving behavior	0.399	***	Accept
Water culture → water-saving behavior	0.486	***	Accept
Water demonstration → water-saving behavior	0.561	***	Accept
Water contribution → water-saving behavior	0.331	***	Accept
Water status → water-saving behavior	0.361	***	Accept

\*\*\* $P < 0.001$ , \*\* $0.001 \leq P < 0.01$ , \* $0.01 \leq P < 0.05$ .

**Table 10.** | Test results with significant mediation effect of propaganda forms and channels.

Model path	Mediating variable		c	ab	c'	ab/c (%)
Water policy → water-saving behavior	Propaganda forms	Text	0.399	0.097	0.306	24.31
		Image	0.399	0.098	0.298	24.56
		Audio	0.399	0.093	0.306	23.31
		Paradigm	0.399	0.100	0.315	25.06
		Activity	0.399	0.117	0.303	29.32
	Propaganda channels	Offline communication platform	0.399	0.114	0.288	28.57
Water culture → water-saving behavior	Propaganda forms	Text	0.486	0.121	0.368	24.90
		Image	0.486	0.071	0.419	14.61
		Audio	0.486	0.111	0.379	22.84
		Video	0.486	0.020	0.468	4.12
		Paradigm	0.486	0.074	0.418	15.23
	Propaganda channels	Activity	0.486	0.077	0.413	15.84
		Newspapers, books, etc.	0.486	0.184	0.303	37.86
		Radio, TV, etc.	0.486	0.043	0.445	8.85
		Network information acquisition platform	0.486	0.074	0.416	15.23
Offline communication platform	Offline communication platform	0.486	0.259	0.226	53.29	
	Propaganda forms	Text	0.561	0.104	0.459	18.54
		Audio	0.561	0.093	0.468	16.58
Propaganda channels	Network communication platform	0.561	0.091	0.473	16.22	
	Offline communication platform	0.561	0.211	0.352	37.61	
Water demonstration → water-saving behavior	Propaganda forms	Text	0.331	0.110	0.225	33.23
		Image	0.331	0.108	0.226	32.63
		Audio	0.331	0.090	0.242	27.19
		Video	0.331	0.033	0.297	9.97
		Paradigm	0.331	0.134	0.202	40.48
	Propaganda channels	Activity	0.331	0.166	0.167	50.15
		Radio, TV, etc.	0.331	0.077	0.254	23.26
		Offline communication platform	0.331	0.165	0.164	49.85
Water contribution → water-saving behavior	Propaganda forms	Text	0.361	0.100	0.263	27.70
		Image	0.361	0.097	0.265	26.87
		Audio	0.361	0.106	0.255	29.36
		Paradigm	0.361	0.120	0.243	33.24
		Activity	0.361	0.149	0.21	41.27
	Propaganda channels	Newspapers, books, etc.	0.361	0.135	0.228	37.40
		Radio, TV, etc.	0.361	0.067	0.294	18.56
		Network communication platform	0.361	0.143	0.22	39.61
		Network information acquisition platform	0.361	0.091	0.27	25.21
		Offline communication platform	0.361	0.171	0.191	47.37

line in the model represents the total effect, and the solid line represents the indirect effect, as shown in Figures 6 and 7.

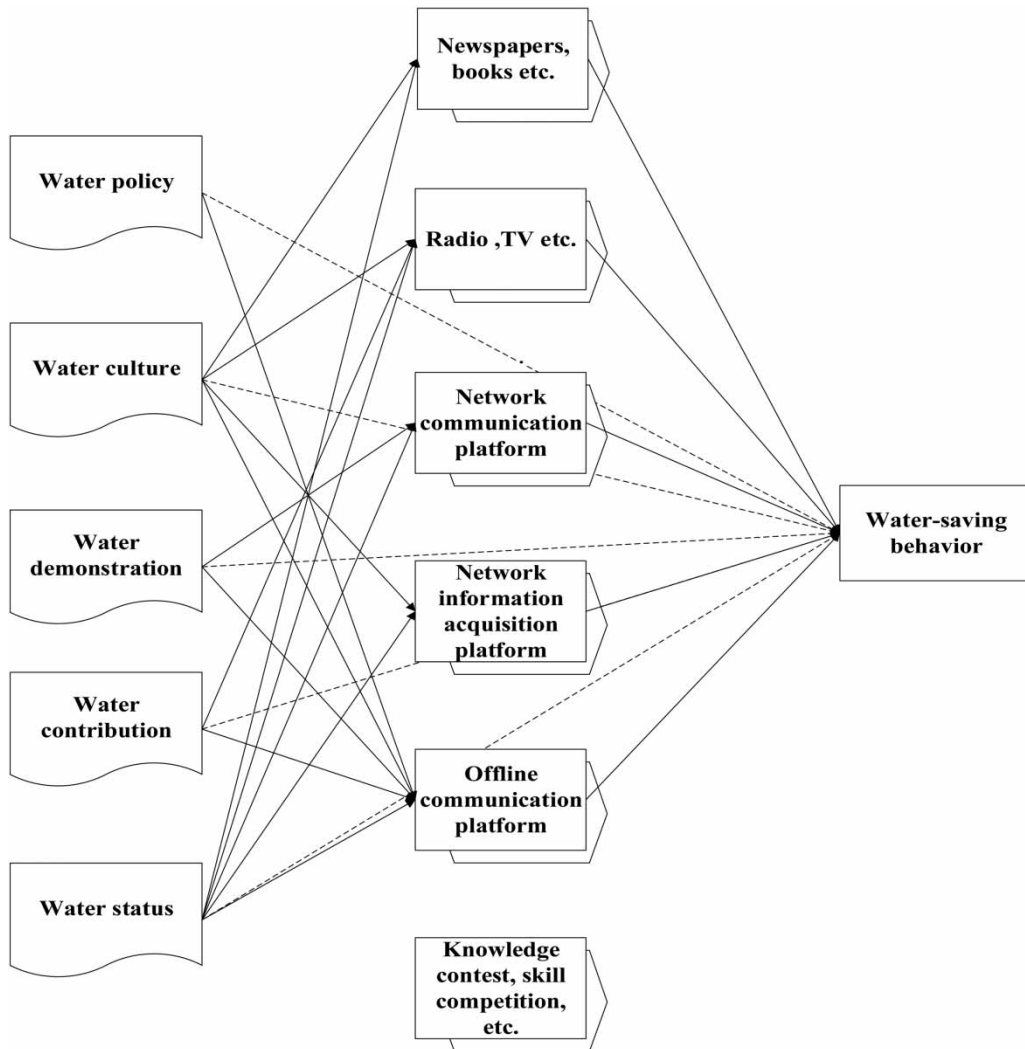


**Fig. 6.** | Impact mechanism model of water commonweal propaganda content on water-saving behavior through propaganda forms.

#### 4. DISCUSSION

It can be seen from Table 11 that the path coefficient values of water demonstration, water culture, water policy, water status, and water contribution on citizens' water-saving behavior are 0.561, 0.486, 0.399, 0.361, and 0.331, respectively, indicating that the five sub-variables all have a significant impact on the improvement of citizens' water-saving behavior. That is to say, the more citizens learn about the water commonweal propaganda, the greater its impact on the improvement of their water-saving behavior. The results indicate that the behavioral change has little to do with propaganda forms or channels in general.





**Fig. 7.** | Impact mechanism model of water commonwealth propaganda content on water-saving behavior through propaganda channels.

**Table 11.** | Influence path of water policy–text–water-saving behavior.

	Estimate	S.E.	C.R.	P	Standardized estimate
Text ← water policy	0.501	0.122	4.111	***	0.274
Water-saving behavior ← Text	0.272	0.042	6.450	***	0.354
Water-saving behaviour ← water policy	0.430	0.097	4.449	***	0.306

\*\*\* $P < 0.001$ .

Though comparing the five sub-variables of the water commonweal propaganda, water demonstration has the most substantial impact on the improvement of citizens' water-saving behavior. Water demonstration mainly refers to the water-saving cities, water-saving communities, large-scale water conservancy projects, well-known water conservancy workers, and water-saving models. These water demonstration cities/communities/water conservancy projects generally respond to the country's water-saving call in real-time and adopt a variety of propaganda forms and channels simultaneously to effectively mobilize more citizens to participate, thereby greatly promoting citizens' water-saving behavior. Most of the water demonstration workers practice water-saving behaviors anytime and anywhere and have become an excellent candidate for citizens to imitate, which can more effectively motivate citizens to improve their water-saving behaviors. The second strongest influence on citizens' water-saving behavior is water culture. Water culture refers to the sum of material heritage and spiritual achievements related to water, such as intellectual wisdom, humanistic works, and custom beliefs. Culture itself has the characteristics of interest and dissemination, and it belongs to the information that citizens are willing to accept. Through the understanding of water customs, the appreciation of waterworks, and the promotion of ancient water control thoughts, citizens will deepen their feelings for water and improve their water-saving behaviors.

Aiming at water policy, the indirect effect of activity is 0.117, which is the most significant value and accounts for 29.32% of the total effect, indicating that activity is the most effective way for water policy to improve citizens' water-saving behavior. Similarly, the mediating indirect effect of offline communication platform was 0.114, accounting for 28.57% of the total, which means that offline communication platform is the most effective way compared with other propaganda channels to improve citizens' water-saving behavior.

Aiming at water culture, the indirect mediation effect of text is 0.121, accounting for 24.9% of the total. It is the best propaganda form according to the results of the intermediary test, indicating that compared with other propaganda forms for water culture, text can improve citizens' water-saving behavior more effectively. The indirect intermediary effects of offline communication platforms such as newspapers and books were 0.259 and 0.184, respectively, accounting for 53.29 and 37.86%. They are the two most effective propaganda channels that have passed the intermediary test. It shows that these two propaganda channels for water culture can promote citizens' water-saving behavior more significantly.

Regarding water demonstration propaganda, the indirect mediation effects of text and audio were 0.104 and 0.093, accounting for 18.54 and 16.58% of the total. There is no big gap between the two, which shows that both text and audio for water demonstration can improve citizens' water-saving behavior more effectively than other propaganda forms. The indirect intermediate effects of network communication platforms and offline communication platforms were 0.091 and 0.211, respectively, accounting for 16.22 and 37.61% of the total. Both of these are communication channels, but the offline communication platform is the most effective propaganda channel that has passed the intermediary test, indicating that the offline communication channels can promote water-saving behavior most effectively.

Regarding the water contribution, the indirect effect of activity is 0.166, accounting for 50.15% of the total. It is the most effective propaganda form that has passed the intermediary test, indicating that activity can better improve water-saving behavior than other propaganda forms for water contribution. The indirect mediation effect of offline communication platforms is 0.165, accounting for 49.85% of the total. It is the best propaganda channel that has passed the mediation test, indicating that offline communication platforms are a more effective way to improve citizens' water-saving behavior compared with other propaganda channels.

For the water status, the indirect effect of activity is 0.149, accounting for 41.27% of the total. It is the most effective propaganda form that has passed the intermediary test, indicating that Activity can improve citizens' water-saving behavior more effectively than other propaganda forms for water status. The indirect mediation

effect of the offline communication platform is 0.171, accounting for 47.37%. It is the best propaganda channel according to the intermediary test results, indicating that offline communication channels can improve citizens' water-saving behavior more significantly.

## 5. CONCLUSION

The water commonweal propaganda is a common means to promote citizens' water-saving behavior. This study conducted an empirical analysis based on the questionnaire and Amos 21.0. The results show that water commonweal propaganda has a positive impact on citizens' water-saving behavior. And compared with water policy, water culture, water contribution, and water status, water demonstration is the most effective way to promote citizens' water-saving behavior.

In term of propaganda forms, the use of Activity for water policy propaganda can effectively promote citizens' water-saving behaviors. The water culture can achieve the best propaganda effect through Text. Similarly, water demonstration can expand the propaganda effect through Text and Audio, both of which can greatly promote citizens' water-saving behavior. Water contribution and water status can be promoted through Activity to improve citizens' water-saving behavior. In term of propaganda channels, offline communication platforms are the most effective way to deliver the knowledge of water policy, water demonstration, water contribution, and water status so that to improve citizens' water-saving behavior. Water culture can be promoted not only through offline communication platforms but also through newspapers, books, etc. Both channels for water culture can effectively promote citizens' water-saving behavior.

Currently, the water commonweal propaganda is carried out through a variety of propaganda forms and channels. Each propaganda form and channel has its own advantages. For different propaganda content, if the government chooses targeted propaganda forms and channels, it can significantly improve its propaganda impact and greatly promote citizens' water-saving behavior. Through this study, it is known that all the contents of water commonweal propaganda have a positive impact on citizens' water-saving behavior, but the generated propaganda impact through different propaganda forms and channels varies.

Finally, based on the results of this study, we put forward some policy recommendations: (1) For China's water conservancy development, it needs to further expand and integrate the existing water commonweal propaganda content, enrich and improve the water commonweal propaganda system; (2) it is crucial to continue to optimize the propaganda forms and channels of the water commonweal propaganda, and to promote their integrated development. It is hoped that this paper can provide important theoretical insights and practical guidance for the subsequent water commonweal propaganda.

Furthermore, since most of the existing research focuses on the promotion of water commonweal propaganda through various propaganda forms and channels, it rarely concerns the propaganda impact, let alone to use questionnaire survey to systematically investigate on their propaganda impact. This study adopts the case of China to test its propaganda impact through investigating the different roles have played by propaganda form and channel. Therefore, this study makes significant contributions to the impact of water commonweal propaganda to change people's water-saving behavior. However, there are also some limitations. In the future studies, the design of the questionnaire can be improved by selecting and comparing different populations and regions to conduct the survey in order to test the results of this study. In addition, the study was only conducted through using questionnaires and did not consider demographic, psychological, social and other factors which can be included in the follow-up research.

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## DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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