Original Research

The Relationship between Subject Value Perception and Behavior Coordination in Air Pollution Collaborative Governance: a Multiple-Step Multiple Mediator Model

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Abstract

Value perception is an important basis for behavior coordination in collaborative governance. Two variables, collaborative ability and relationship quality, were introduced to form the theoretical framework of "perceived-competency-relations-behavior". A chain-mediated model was constructed to explore the mediating effects of collaborative ability, relationship quality, and their joint influence on the relationship between value perception and behavior coordination. The results show that: value perception can significantly enhance behavior coordination in atmospheric collaborative governance; collaborative ability and relationship quality respectively serve as a mediator between value perception and behavior coordination; collaborative ability and relationship quality jointly play a chain mediating role between value perception and behavior coordination. The conclusions enrich the research on the intrinsic mechanism of value perception affecting behavior coordination, and can provide a reference for decision-making in exploring behavior coordination paths.

Keywords: value perception, collaborative ability, relationship quality, behavior coordination

Introduction

With the rapid development of science, technology and economy as well as the upsurge of energy consumption, urban air pollution is getting more and more serious, which has seriously jeopardized human health and ecological environment, and become the gravest environmental problem faced by cities. Therefore, how to achieve effective control of air pollution has been a grand challenge for the sustainable development of the current economy and society. In the process of air pollution management, how to form effective cooperation among the control subjects and realize the coordination of air pollution management is an important way to fulfill the effective prevention and control of air pollution. Thus, air pollution collaborative management has become a hot issue in the current

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research on air pollution control. Many researchers have proposed air pollution collaborative governance based on the efficient participation, interaction and cooperation of multiple subjects such as governments, enterprises, social organizations and the public. Ansell et al. (2008) [1] argue that collaborative governance is an institutional arrangement that directly involves stakeholders from multiple government and non-government departments in the formal, consensus-oriented, collective decision-making process aimed at formulating or implementing public policies or managing public affairs. Emerson et al. (2012) [2] consider collaborative governance as the progress of public policy formulation and management for a common purpose in the public domain, involving people constructively across the public sector, different levels of government, or the public, individuals and social groups.

In the study of air pollution collaborative governance, scholars pay attention to collaborative governance driving factors, collaborative behaviors, framework models, collaborative mechanisms, etc. In terms of the driving factors of atmospheric collaborative governance, some scholars regard atmospheric environmental awareness as a prominent factor affecting the attainment and stability of cooperation. Feng et al. (2018) [3] contend that as the level of environmental awareness raises, the areas involved in cooperation and the benefits of cooperation will increase, and thus the stability and effectiveness of cooperation will also be enhanced accordingly. Peng et al. (2019) [4] assert that environmental perceptions can have a critical impact on the achievement of cooperation. Based on 14 typical cases from 11 countries, Yang et al. (2016) [5] concluded that effective and diverse actors' participation, large collaborative scale, open collaborative network, close collaborative relationship, and cooperative nature of the relationship jointly contribute to successful collaborative governance outcomes. According to the findings of Jing et al. (2019) [6], the air pollution governance ability, the support from the superior government and the public have a significant impact on the "formation" of collaborative governance, while the credibility of governance subjects, the air pollution governance ability, expected benefits and public support have a significant impact on the "maintenance" of collaborative governance. In the research of collaborative governance behavior, more scholars have studied collaborative behavior from the perspective of evolutionary game. Mehdi et al. (2021) [7] discussed the action choice problem of river allocation and prevention among three countries based on cooperative game theory. He et al. (2020) [8] systematically analyzed the game behavior between government regulation and corporate emissions in environmental prevention and control with the repeated game model. Wang et al. (2019) [9] studied the "action" game and collaborative factors of air pollution control in Beijing-Tianjin-Hebei under different scenarios,

and the results indicated that the establishment of a sound information sharing mechanism, supervision and constraint mechanism, benefit distribution mechanism and cost-sharing mechanism could promote the effective interaction based on the upgrading of governance efficiency in the region. Luo et al. (2019) [10] constructed the game model of government and enterprises in environmental governance, and studied their collaborative behavior in environmental governance under the environmental tax system. In the study of collaborative governance framework models, scholars construct framework models of actions between different organizations or departments within organizations. Bryson et al. (2020) [11] established an analytical framework of cross-department collaboration from five aspects: initial conditions, processes, structure and governance, contingencies and constraints, and outcomes and responsibilities. Based on the principle of system dynamics, Guo et al. (2016) [12] constructed a 3E system dynamics model of environmental collaborative governance for the integrated development environment of Beijing-Tianjin-Hebei, which validated the effectiveness of environmental collaborative governance for integrated development. In collaborative mechanism research, scholars have studied the synergistic cooperation mechanism among regions, functional departments and stakeholders. Based on the collaborative practice of Beijing-Tianjin-Hebei, Wei et al. (2018) [13] investigated the collaborative system of governance mechanism and institutional logic of air pollution, and found that the cooperative mode "task-driven" is effective, but belongs to an emergency coordinated way. It is recommended to build a normal collaborative air pollution control mechanism. He et al. (2019) [14] systematically elaborated on the implementation effects of the joint air pollution control mechanism in the Beijing-Tianjin-Hebei region from the aspects of its development history, target effect, mechanism framework and measures. Based on the "structurally process" model, Wu et al. (2020) [15] proposed that in the implementation of regional air pollution collaborative governance, the structural and process mechanisms are mutually dependent on each other, and the key to their effectiveness is to decrease the efficiency cost and the risk of cooperation.

The summary and analysis of the above research work reveal that the research on collaborative governance of air pollution has been conducted in terms of collaborative driving factors, cooperative game of collaborative process, collaborative influence of framework models and operational mechanisms, etc. These studies have laid a significant foundation for the theoretical framework of collaborative control of air pollution. However, less research has been done on how the behavior coordination of air pollution control subjects in the region is formed. For example, whether there is a correlation between the value perception and behavior coordination of each subject in the collaborative process, whether the ability

and mutual relationship of governance subjects influence the formation of collaborative behaviors, and how the specific mechanism of action works requires further study. Therefore, this paper takes the main body behavior coordination formation and collaborative mechanism as the research object, and constructs a chain mediation model. Furthermore, this paper studies the influence and relationship between the value perception, collaborative ability, relationship quality and behavior coordination of governance subjects, the mediating role of the collaborative ability and relationship quality between the value of collaborative perception and action respectively, clarifies the mechanism of the chain mediating effect of collaborative ability and relationship quality. Consequently, this study can furnish theoretical and practical support for promoting collaborative action of air pollution control and strengthening the collaborative effect.

Theoretical Hypotheses

Value perception refers to an individual's comprehensive subjective evaluation of the effects of a product or service based on his gains and losses, reflecting the balance between gains and losses [16]. Value perception was first introduced in the field of consumer behavior research by Zeithaml et al. (2020) [17], who found that the more individuals perceive the benefits of a commodity or service to themselves, the higher the level of value perception, which can significantly promote individuals' willingness to use the commodity or service. According to Khamseh and Jolly's analysis, each subject will engage in the cooperative relationship only when they perceive that they can obtain beneficial outcomes, which include both individual benefits and public value benefits [18]. Scholars in other fields have also concluded that value perceptions contribute to behavioral intentions and use behaviors. Therefore, the value perception in air pollution collaborative management can be regarded as the value judgment made by individuals or organizations weighing "profit and loss" in collaborative management. When individuals or organizations subjectively deem that the gain or value created by collaborative efforts is relatively high, the level of value perception is naturally high, which can promote the behavior coordination of individuals or organizations. For this reason, the following hypothesis is proposed:

H1: value perception has a positive impact on behavior coordination.

The main connotation of the resource-dependence theory is that resources are limited, and no organization can be self-sufficient in such condition. Resource dependence is the foundation for the formation of air pollution collaborative management of multiple entities. When both organizations of resource exchange have strong resource dependence, cooperation between them is more likely to be reached, and the ability of

such two parties to contribute to more cooperation is mainly reflected in their resource advantages and the dependence of other organizations on such resource advantage. From the perspective of dynamic capability theory, collaborative ability is a kind of dynamic ability, which refers to the ability of an organization to integrate, construct and reconfigure internal and external resources in order to adapt to the changing environment [19]. To survive and develop, an organization must obtain corresponding resources. When the required resources are controlled by other organizations, the organization will exchange resources with other organizations in charge of relevant resources, and a cooperative relationship must be formed [20]. In emergency management, the more emergency resources the government has, the richer the variety, the higher the sharing degree, the more reasonable the allocation of personnel and resources, and the higher the collaborative ability. The abundant emergency resources will ensure the maximum collaborative effect [21]. Rhodes (2017) [22] argues that the collaborative ability of subjects is the key to collaborative governance, and the more resources the collaborating parties have and can allocate, the stronger their collaborative ability. They can effectively reduce the cost of cooperative governance on the one hand, and attract the participation of other subjects, promote the cooperative parties to achieve collaborative behavior on the other hand. Marlow et al. [23] contend that the more comprehensive the content of intersectoral communication, the more intersectoral consensus will be achieved, which will facilitate the formation of common goals among departments, strengthen cooperation between departments, and thus enhance the cross-department collaborative ability. Based on the study of emergency cooperation among local governments, Benton [24] pointed out that sufficient emergency resources can meet the needs and expectations of the public, so as to ensure sustained and in-depth cooperation. Through these studies, the collaborative ability in collaborative governance of air pollution can be understood in two aspects. Firstly, the collaborative subjects have the resources required by their partners in the collaborative process and can share the owned resources. Secondly, the collaborative subject can integrate, construct and reconfigure resources in the collaborative process to promote synergy. And the following hypotheses are put forward:

H2: Collaborative ability plays a positive mediating role between value perception and behavior coordination.

Relations refer to the condition of interaction and mutual influence between things. Air pollution collaborative management has typical social characteristics of different types of multiagent cooperation. The cooperative behavior of each subject, the solution of common problems, the open exchange of information, and the realization of common values generally cannot be stipulated in specific terms.

The relationship quality is used in the study to specifically measure the collaborative relationship. Martinez et al. (2021) [25] used two dimensions of satisfaction and trust to reflect relationship quality. Eddleston et al. [26] pointed out that trust and commitment are the prominent factors affecting relationship quality. Some scholars also regard communication, trust and commitment as the most important dimensions of relationship quality [27]. Deng et al. [28] deemed that in a risky communication context, relationship quality is mainly manifested in three dimensions: trust, communication and fairness. In this paper, trust, communication and commitment are used to describe relationship quality.

Nippa et al. [29] argued that trust is a benign mechanism that moderates the relationship between formal management control and alliance performance. Trust is considered to be "the cornerstone of strategic partnership" in alliances. Trust can facilitate the formation of cooperation as it mitigates the risk of cooperation and boosts the output of cooperation. Walter et al. [30] pointed out that effective communication and access to relevant information about each cooperating party are the sources of partnership vitality. From the perspective of social psychology, Baralou et al. [31] argued that effective information communication between enterprises promoted the establishment of team relationships between both parties. It is generally accepted that effective communication can facilitate coordination, thereby promoting the formation of collaborative organization. Effective information communication can significantly reduce and ease contradictions and conflicts in collaborative organizations, enhance trust, and promote behavior coordination between subjects. Borekci et al. [32] pointed out that commitment is one of the core components of long-term relationships, and that effective and lasting commitment can have a positive sustaining effect on the existence of the relationship. Eddleston et al. [26] observed that trust and commitment play a pivotal role. Shared values and commitment can facilitate cooperation between relationship members, reduce the willingness of trading partners to separate, and enhance the degree of trading cooperation.

Through the case study of crisis response, Wukich [33] concluded that the higher the quality of information communication sharing, that is, the higher the degree of accuracy, timeliness and consistency of information, the more conducive it will be to the completion of collaborative cooperation. For air pollution collaborative management, the lack of power constraints among multiple subjects, especially among non-governmental organizations, leads to instability in mutual relationships. And mutual relationships including trust, communication and commitment, can effectively reduce the uncertainty, cut down the transaction costs of the solution of instability, and promote effective cooperation among subjects.

Therefore, the following hypotheses are proposed:

H3: Relationship quality plays a positive mediating role between value perception and behavior coordination.

Christopher [34] found in his empirical research of manufacturing enterprises that one party's unique resources in business dealings with trading partners will lead to the other party's positive trust and commitment. In the collaborative governance relationship, each participant should have sufficient capabilities and unique resources to support itself in its collaborative tasks [35]. "Participants' resources" is a requirement for the qualification of governance subjects, and organizations unable to provide public services are not qualified to engage in collaborative governance [36]. Because cooperation is based on mutual needs, the complementarity and coordination of each subject in terms of governance capabilities and resource mastery are potential conditions that facilitate the formation of collaborative governance relationship [37]. The conflict coordination of collaborative governance no longer depends on the power structure, but each subject acquires a new authority according to its ability and resources, returning the negotiation ability of each party to a reciprocal level and maintaining a relatively balanced and pluralistic dynamic cooperative relationship [38]. Air pollution collaborative governance is part of public governance. When each governance subject has a strong collaborative ability of resource sharing and reconfiguration, collaborative subjects will show strong dependence, and each subject will autonomously enhance communication and promote mutual relationships, so as to achieve better relationship quality. Meanwhile, in the process of organizational cooperation, it is necessary to control the risk of inter-organizational cooperation through trust, communication and commitment to improve the collaborative ability. Especially for the cooperation among multiple subjects with large distinctions, such as public sectors, private sectors, non-profit social organizations and the public, it is more necessary to build mutual relationships including trust, communication and commitment to eliminate the target preferences and cooperation risks among the governance subjects, so as to improve the collaborative ability between the subjects. During the collaborative process of multiple subjects, collaborative ability and relationship quality interact and promote each other.

Therefore, the following hypotheses are proposed:

H4: Collaborative ability plays a remote mediating role between value perception and behavior coordination through relationship quality.

H5: Relationship quality plays a remote mediating role between value perception and behavior coordination through collaborative ability.

In summary, the conceptual models of this paper are shown in Fig. 1 and Fig. 2.
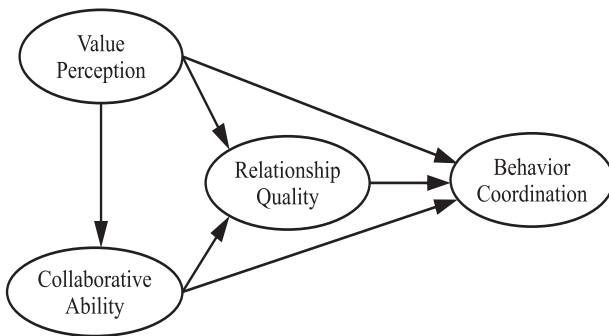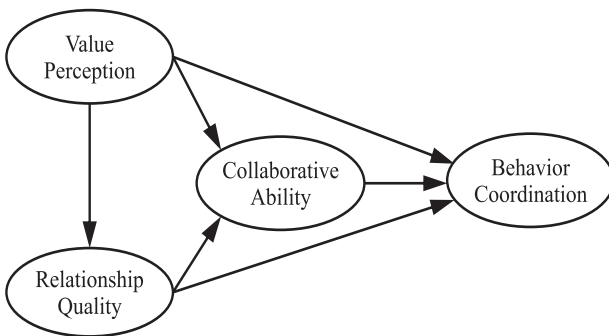
Fig. 1. Conceptual Model 1.

Fig. 2. Conceptual Model 2.

Methodology and Data

In order to enhance the preciseness of sample data collection and minimize the impact of industry categories on the results, this study selected researchers from universities and research institutes, enterprise staff, government staff, personnel from social welfare organizations and the general public in Harbin as samples. The research methods included both network research and non-network research. In the process of sample data collection, multi-source data and item meaning concealment were adopted to reduce homologous error. The sample data came from different industry subjects, 100 questionnaires were respectively sent to government personnel, enterprise staff, university and scientific research personnel, public welfare organization personnel and the public, and 500 questionnaires were sent in total, 412 were collected with a recovery rate of 82.4%. After further sorting and screening, 339 samples were finally used for analysis.

All the variables were measured using a seven-point Likert-type scale ranging from 1, "strongly disagree" to 7, "strongly agree".

The question design and scale of value perception are mainly based on the literature of Li [39] and Shukla [40]. And the scale is adjusted and modified according to the traits of the value concept of air pollution collaborative governance. The question items mainly include two dimensions, public value perception and individual value perception, with four items

(VP1 - VP4), which are "collaborative governance can alleviate the pollution in the region", "collaborative governance is less costly than solo governance", "collaborative governance can increase the technology, ability and experience of governance", "collaborative governance can promote green development in the region".

The question design and scale of collaborative ability are mainly based on the literature of Chen [21], Luo [41], etc. Considering the topic and the actual content of this study, the scale was adjusted and modified accordingly from two dimensions of its resources and resource deployment capacity. There are four items (CA1-CA4), which are "the other party has sufficient capacity to cooperate", "we can integrate each other's resources", "we can coordinate interests in cooperation" and "we can control responsibilities".

The scale is adapted and modified from the three dimensions of trust, communication and commitment, mainly adopting the measurement work compiled by Liu et al. [42] and McAllister [43]. There are six items (RQ1-RQ5), which are "the collaborative subjects are honest and reliable", "the communication channels among collaborative subjects are smooth", "the information exchange among collaborative subjects is effective and sufficient", "the benefits and risks are fairly distributed among collaborative subjects", and "collaborative subjects will fulfill their commitments as agreed even without supervision".

With reference to the measurement methods of Cao et al. [44] and Hambrick [45], combined with the research theme and actual content, four items (BC1-BC4) are applied: "there is a unified and clear task objective among the collaborative subjects", "the collaborative subjects can successfully complete the collaborative tasks", "information is disclosed in a timely and accurate manner during the collaborative process", and "there are fast and effective communication channels among the collaborative subjects".

The anonymous method is adopted during the questionnaire distribution process to diminish the common method deviation (CMV) arising from the same subjects or data sources, single time point, etc. Meanwhile, this study utilizes the single-factor model comparison method [46] and the common method factor verification method [47]. The test results are shown in Table 1 and Table 2. As can be seen from Table 1, there is a remarkable difference between the single-factor model and the original model, and the original model is significantly better than the single-factor model. As can be seen from Table 2, the changes in all the major matching indexes of the correlation ratio between the common method factor model and the original model are less than 0.02, indicating that the model did not change apparently after adding the common method factor. The comprehensive comparison demonstrates that there is no serious common method bias in the variables of this study, which will not affect the research conclusions of this paper.

Table 1. Results of single factor CFA comparison method.

Model	χ^2	DF	$\Delta\chi^2$	ΔDF	P
Single Factor	928.33	119	720.87	6	0.000
Multi Factor	207.46	113			

In this paper, combined reliability (CR) and item load were employed to test the reliability of the questionnaire, confirmatory factor analysis (CFA) was applied to test the structural validity, and AVE was adopted to evaluate the aggregate validity of the scale (see Table 3). In addition, this paper used the correlation between potential variables to test the discriminant validity (see Table 4).

To measure the internal consistency reliability, convergent validity and discriminant validity of the constructs in our proposed model, we performed CFA analysis on the four constructs of value perception, collaborative ability, relationship quality and behavior coordination (see Table 3). The results revealed that the composite reliability (CR) of each construct ranged from 0.832 to 0.900, exceeding the CR threshold value of 0.60, and giving evidence of internal consistency reliability [48, 49]. Meanwhile, the average variance extracted (AVE) of all constructs ranged from 0.554 to 0.694, exceeding the AVE threshold value of 0.50 [48, 49], and thus the convergent validity was acceptable. Moreover, the square roots of the AVE all constructs ranged from 0.744 to 0.833. Table 4 indicates that the estimated inter-correlations among all constructs were

Table 2. Validation results by adding common method factors.

Model	CFI	IFI	NFI	Standardized RMR	RMSEA
Common Factor	0.950	0.986	0.961	0.0345	0.040
Multi-Factor	0.932	0.974	0.945	0.0364	0.050
Δ	0.018	0.012	0.016	0.001	0.010
Reference Value	<0.020	<0.020	<0.020	<0.020	<0.020

Table 3. Reliability and validity evaluation indexes of the measurement scale.

Dimensions	Title	Parameter significance estimation				Factor load	Questions reliability	Component reliability	Convergent validity
		Unstd.	S.E.	t-value	P	Std.	SMC	CR	AVE
VP	VP1	1.000				0.679	0.461	0.832	0.554
	VP2	1.189	0.104	11.480	***	0.769	0.591		
	VP3	1.304	0.111	11.705	***	0.797	0.635		
	VP4	1.154	0.101	11.386	***	0.727	0.529		
CA	CA1	1.000				0.848	0.719	0.900	0.694
	CA2	1.024	0.050	20.688	***	0.908	0.824		
	CA3	0.832	0.053	15.600	***	0.736	0.542		
	CA4	0.938	0.051	18.458	***	0.832	0.692		
RQ	RQ1	1.000				0.798	0.637	0.891	0.620
	RQ2	1.083	0.066	16.406	***	0.828	0.686		
	RQ3	0.982	0.065	15.099	***	0.778	0.605		
	RQ4	0.882	0.060	14.670	***	0.757	0.573		
	RQ5	1.002	0.066	15.105	***	0.774	0.599		
BC	BC1	1.000				0.746	0.557	0.888	0.666
	BC2	1.162	0.074	15.736	***	0.888	0.789		
	BC3	1.116	0.075	14.983	***	0.818	0.669		
	BC4	0.995	0.068	14.711	***	0.805	0.648		

Note: *** is P <0.001,** is P <0.010, and * is P <0.050

Table 4. Mean, variance and square root of AVE of latent variables.

	AVE	Value perception	Collaborative Ability	Behavior Coordination	Relationship Quality
Value perception	0.554	**0.744**			
Collaborative Ability	0.694	0.733	0.**833**		
Behavior Coordination	0.666	0.701	0.714	**0.816**	
Relationship Quality	0.620	0.689	0.659	0.689	**0.787**

Table 5. Fit indices.

Fit indices	Model value	Reference Value	Overall model fit
χ^2/df	1.836	<5.00	Yes
GFI	0.932	>0.90	Yes
AGFI	0.908	>0.90	Yes
CFI	0.974	>0.90	Yes
IFI	0.974	>0.90	Yes
TLI	0.969	>0.90	Yes
Standardized RMR	0.036	<0.05	Yes
RMSEA	0.050	<0.10	Yes

less than the square roots of the AVE in each construct, which provides preliminary support for discriminant validity [50].

To ensure the validity of the hypothesis testing results, the goodness of fit of the overall model, including the explanatory variables, the explained variables and the two mediating variables, was tested before hypothesis testing of the theoretical model. We performed SEM analysis to measure the fit and path coefficients of the hypothesized model. Meanwhile, we estimated model fit by adopting the chi-square (χ^2) value, degrees of freedom (df), value of χ^2/df, goodness of fit index (GFI), adjust goodness of fit index (AGFI), comparative fit index (CFI), incremental fit index (IFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA). The recommended reference values of these indices are

shown in Table 5. The results indicate that the model fits well.

Empirical Results and Discussion

The structural equation model was applied to test the relationship between value perception, collaborative ability, relationship quality and behavior coordination. The paths and the corresponding testing results of Model 1 and Model 2 are shown in Table 6 and Table 7, respectively.

The testing results shown in Table 6 and Table 7 demonstrate that in air pollution collaborative governance, value perception can significantly enhance behavior coordination (r = 0.254, P <0.01), and hypothesis H1 holds. Furthermore, collaborative ability remarkably promotes behavior coordination (r = 0.335, P<0.001), and relationship quality has a distinctly positive effect on behavior coordination (r = 0.293, P<0.001). Value perception positively affects collaborative ability (Model 1: r = 0.733, P<0.001; Model 2: r = 0.531, p<0.001) and relationship quality (Model 1: r = 0.445, P<0.001; Model 2: r = 0.689, p<0.001). There is also a significant positive correlation between collaborative ability and relationship quality (Model 1: r = 0.333, P <0.001; Model 2: r = 0.294, p<0.001).

For the test of mediating effect, Baron et al. [51] proposed the stepwise regression method, which is simple to operate and easy to understand but has disadvantages such as unfavorable statistical effects and poor test results. The Sobel Test Mediation Test makes up for some defects of the stepping-regression method, but it requires the sample to meet the hypothesis of normal distribution when used [52]. With regard to

Table 6. Summary of the paths and the corresponding testing results of Model 1.

Path to the relationship between			Unstd.	S.E.	t-value	P	Std.
Value Perception	→	Behavior Coordination	0.231	0.076	3.049	0.002**	0.254
Collaborative Ability	→	Behavior Coordination	0.268	0.060	4.479	***	0.335
Relationship Quality	→	Behavior Coordination	0.295	0.070	4.191	***	0.293
Value Perception	→	Collaborative Ability	0.836	0.074	11.245	***	0.733
Value Perception	→	Relationship Quality	0.404	0.078	5.189	***	0.445
Collaborative Ability	→	Relationship Quality	0.265	0.063	4.195	***	0.333

Table 7. Summary of the paths and the corresponding testing results of Model 2.

Path to the relationship between			Unstd.	S.E.	t-value	P	Std.
Value Perception	→	Behavior Coordination	0.231	0.076	3.049	0.002**	0.254
Collaborative Ability	→	Behavior Coordination	0.268	0.060	4.479	***	0.335
Relationship Quality	→	Behavior Coordination	0.295	0.070	4.191	***	0.293
Value Perception	→	Collaborative Ability	0.605	0.088	6.877	***	0.531
Value Perception	→	Relationship Quality	0.626	0.063	9.882	***	0.689
Relationship Quality	→	Collaborative Ability	0.369	0.088	4.192	***	0.294

the shortcomings of the above methods, Bootstrapping is more advantageous, and can obtain relatively significant statistical efficiency without the assumption of normal distribution [53]. Therefore, Hayes [54], after a comparative analysis, suggested the Bootstrapping method to test the mediating effect.

Hence, the Bootstrapping technique was applied to estimate the criteria and confidence intervals for indirect effects to analyze the mediating effect of collaborative ability and relationship quality. Firstly, check the comprehensive effect of the interaction between variables. If a comprehensive effect is checked to exist, it indicates that the indirect effect must exist. Secondly, check the indirect effect. If an indirect effect is checked to exist, it indicates that a mediating effect must exist. Finally, check the direct effect. If the direct effect is smaller than the total effect but significant, it could be judged as a partial mediating effect; if it is not significant, it is judged as a complete mediating effect, and the strength of mediating effect refers to the z-value in Bootstrapping.

The comprehensive effect of value perception and behavior coordination was analyzed to test whether there is a mediating effect between the two variables. The test results are shown in Table 8. The results of the table indicate that in the Bootstrapping test method, the confidence interval between value perception and behavior coordination does not contain 0, and the Z value is greater than 1.960. There are total effect and indirect effect between value perception and behavior coordination, while the direct effect is significant, demonstrating that this model is an indirect mediation model, that is, there is a mediation effect between value perception and behavior coordination.

The mediating effect of collaborative ability and relationship quality on value perception and behavior coordination was analyzed and tested. According to Model 1 and Model 2, there are three mediating paths between value perception and behavior coordination. For Model 1, the three mediating paths include that value perception affects behavior coordination through collaborative ability, value perception affects behavior coordination through relationship quality, and collaborative ability plays a remote mediating role between value perception and behavior coordination through relationship quality. For Model 2, the three mediating paths include that value perception affects behavior coordination through collaborative ability, value perception affects behavior coordination through relationship quality, and relationship quality plays a remote mediating role between value perception and behavior coordination through collaborative ability.

According to Hayes et al. [53] and Fletcher [55], the specific mediating effects of the mediating paths in Model 1 and Model 2 were calculated and tested, and the results are shown in Table 9 and Table 10. The mediating effects of the paths in Model 1 are 0.224, 0.119 and 0.065, respectively, and the corresponding mediating effects in Model 2 are 0.162, 0.184 and 0.062. The confidence intervals of the three mediating paths of the two models do not contain 0, demonstrating that the specific mediating effects of the three mediating paths all exist. In other words, collaborative ability and relationship quality respectively have mediating effects, which can influence the relationship between value perception and behavior coordination. Value perception can not only act on behavior coordination through the respective mediating effects of collaborative ability

Table 8. Comprehensive effect between value perception and behavior coordination.

Path	Effect	Point estimation	Product of Coefficients		Bootstrapping			
					Bias-corrected 95% CI		Percentile 95% CI	
			SE	Z	Lower	Upper	Lower	Upper
Value perception	Total	0.640	0.069	9.275	0.516	0.783	0.510	0.776
→	Indirect	0.409	0.072	5.681	0.280	0.565	0.264	0.554
Behavior Coordination	Direct	0.231	0.092	2.511	0.064	0.423	0.064	0.421

Table 9. Mediation and chain mediating effect in Model 1.

Path	Point estimation	Product of Coefficients		Bootstrapping			
				Bias-corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
VP→CA→RQ→BC	0.065	0.024	2.708	0.028	0.123	0.023	0.116
VP→CA→BC	0.224	0.060	3.733	0.114	0.356	0.108	0.347
VP→RQ→BC	0.119	0.038	3.132	0.056	0.212	0.050	0.200

Table 10. Mediation and chain mediating effect in Model 2.

Path	Point estimation	Product of Coefficients		Bootstrapping			
				Bias-corrected 95% CI		Percentile 95% CI	
		SE	Z	Lower	Upper	Lower	Upper
VP→RQ→CA→BC	0.062	0.023	2.696	0.027	0.122	0.023	0.115
VP→CA→BC	0.162	0.048	3.375	0.081	0.272	0.075	0.262
VP→RQ→BC	0.184	0.050	3.240	0.095	0.393	0.087	0.284

and relationship quality, but also affect behavior coordination through the two mediating chains formed by collaborative ability and relationship quality. Therefore, hypothesis H2, H3, H4 and H5 are verified. Sobel Test was used to test the difference degree of mediating effects between VP→CA→RQ→BC and

Table 11. Strength of mediating effect in Model 1.

Path	Path coefficient	Mediation effect	Indirect effects	Strength
VP→CA	0.836	0.224		0.548
CA→BC	0.268			
VP→RQ	0.404	0.119		0.291
RQ→BC	0.295		0.409	
VP→CA	0.836			
CA→RQ	0.265	0.065		0.159
RQ→BC	0.295			

Table 12. Strength of mediating effect in Model 2.

Path	Path coefficient	Mediation effect	Indirect effects	Strength
VP→CA	0.605	0.162		0.397
CA→BC	0.268			
VP→RQ	0.626	0.184		0.451
RQ→BC	0.295		0.409	
VP→CA	0.626			
CA→RQ	0.369	0.062		0.152
RQ→BC	0.268			

VP→RQ→CA→BC. The Z value was 1.910, less than 1.960, and there was no significant difference between the two remote mediating paths.

The strength of mediating effect in Model 1 and Model 2 are shown in Table 11 and Table 12. It can be seen that the strength of remote mediating effect for VP→CA→RQ→BC in Model 1 and VP→RQ→CA→BC in Model 2 are 0.159 and 0.152, respectively, i.e., the strength of the two remote mediations is basically the same. Based on the comparison of the two remote mediations, it can be concluded that the two remote mediations have the same role between value perception and behavior coordination, and collaborative ability and relationship quality positively promote each other in the remote mediation.

Conclusions and Policy Implications

This study introduces two significant concepts that influence behavior coordination, collaborative ability and relationship quality, constructs a chain mediation model of the relationship between value perception and behavior coordination, explores the mechanism of value perception driving behavior coordination, and tests the mediating effects of collaborative ability and relationship quality. The results indicate: (1) Value perception has a remarkable promoting effect on behavior coordination. It shows that value perception is an essential premise to enhance behavior coordination. As a comprehensive carrier of individual and public value benefit, it forms public value beneficial to synergism and effectively boosts the behavior coordination of collaborative subjects through effective guidance to them and efficient interaction between them. (2) Collaborative

ability and relationship quality play mediating roles between value perception and behavior coordination, respectively. As a concrete manifestation of the ability of cooperative subjects to own and allocate resources, the strength of cooperative ability is the degree of resource dependence among cooperative subjects, which provides a prominent material basis for behavioral cooperation. As the external state of interaction and mutual influence between collaborative subjects, a high level of relationship quality can effectively reduce the uncertainty between collaborative subjects, cut down collaborative costs, diminish instability, and promote effective cooperation between the subjects. (3) Collaborative ability and relationship quality play a chain mediating role between value perception and behavior coordination. Relationship quality and collaborative ability significantly and positively promote each other in the remote mediation between value perception and behavior coordination, which can change the interaction intensity between value perception and behavior coordination. It also reveals the realization path of collaborative subjects from value perception to behavior coordination, i.e., behavior coordination can be effectively promoted by adjusting the amount of resources of the collaborative subject and facilitating the formation of high-level relationship quality. In conclusion, this study enriches the internal mechanism between value perception and behavior coordination, and provides new ideas and decision-making guidance for the multi-agent realization of collaborative governance path.

The theoretical contributions of this study include three aspects. First, based on the theory of resource dependence, it is proposed that collaborative ability not only reflects the resources possessed, but also the ability to integrate, construct and reconfigure resources to promote collaborative ability. The effective collaborative ability can efficiently trim down the cost of collaborative governance on the one hand, and attract the participation of other subjects and promote the synergistic parties to achieve synergistic behavior on the other hand, thus verifying the mediating role of collaborative ability. Second, at the relationship level, this study applies trust, communication and commitment to elaborate on the relationship quality of cooperative subjects. For air pollution collaborative governance, a high level of relationship quality can efficiently overcome the relationship instability caused by the lack of power constraints among subjects. A high level of relationship quality can significantly reduce uncertainty, cut down transaction cost and resolve the instability of the relationship, promote effective cooperation between subjects, and thus verify the mediating role of relationship quality. Third, unlike the research on the single mediation mechanism between value perception and behavior coordination, this paper develops a theoretical framework of "perception-ability-relationship-action". By incorporating collaborative ability and relationship

quality into the research framework, this study explores the internal logic of value perception and behavior coordination, verifies the remote mediating role of collaborative ability and relationship quality, seeks the feasible path to promote behavior coordination, and investigates the influence of value perception in atmospheric collaborative governance from the perspective of ability and relationship. It not only further deepens the understanding of the relationship between value perception and behavior coordination, but also furnishes a theoretical basis for realizing the transformation from value perception to behavior coordination.

In addition, the findings of the study have some management implications for air collaborative governance. First, cultivating collaborative governance value perception, especially public value perception, has an essential effect on promoting collaborative subjects to achieve behavior coordination. In the field of atmospheric collaborative governance, public value perception is the value basis of behavior coordination. In the practice of atmospheric collaborative governance, the formation of public value perception plays an important role. In the process of practice, the government is not only the subject of collaborative governance, but also the advocate and leader of collaborative governance, leading and facilitating the formation of public value perception. Second, it is necessary to pay more attention to collaborative ability building and relationship quality improvement, so as to provide a feasible path for the transformation from value perception to behavior coordination. It supplies collaborative subjects with an effective behavior coordination approach, that is, enhances behavior coordination through the process of optimizing resource allocation by the government, the lead of collaborative governance, to improve the collaborative ability of enterprises, social organizations and the public. Also, it promotes behavior coordination through the process of strengthening information disclosure, boosting information sharing, building mechanisms of exchange, communication and constraint to improve relationship quality, etc. Limited by subjective and objective conditions, this study has the following shortcomings. First, the sample mainly comes from researchers of universities and research institutes, enterprise staff, social organizations, relevant government personnel and general public in northern cities, among which government-related personnel and personnel of social welfare organizations are fewer. The scope of cities and related groups can be expanded later to verify the theoretical model proposed in this paper and improve the universality of the research results. Secondly, this paper analyzes the mediating role of collaborative ability and relationship quality between value perception and behavior coordination. However, the moderating effect of environmental regulations may also exist at the same time, and more in-depth research can be carried out in the future on behavior coordination.

Acknowledgments

Conflict of Interest

The authors declare no conflict of interest in this paper.

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