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A Study on the Marine Pollution Response Institutions in China from the Perspective of New Institutionalism

지도교수 강 윤 호

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통상행정학과 행정학전공

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한국해양대학교 대학원

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LI JIA

Department of International Commerce and Marine Administration
Graduate School of Korea Maritime and Ocean University

Abstract

Based on the basic ideas of sustainable development and the importance of marine environmental protection, this study analyzes the current states of China's marine environmental protection response institution from the perspective of the IAD framework. The analysis results show that the enthusiasm of participants (government, public and polluters) in China's marine environmental response institution needs to be improved, while the driving force for polluters to increase anti-pollution equipment is not strong. The members of local government have not been fully mobilized yet. On top of

that, the work links among government departments are cumbersome and the public are lack of effective channels to participate in government affairs. In addition, this study also finds that there are problems in the coordination of participants. Such coordination issues do not only exist within the government itself, but also between the government and polluters in pollution accidents, as well as between the government and the public. At the end of the study, based on the 7 rules of IAD framework, this study puts forward 4 suggestions for improvement in China's current marine environmental response institution. Particularly, this study suggests to improve the entry and exit mechanisms of participants in the boundary rules; to mobilize participants' enthusiasm in a variety of ways; to improve the legal system related to oil spills; and to improve the regulatory links through aggregation rules.

KEY WORDS: Marine environmental protection; IAD framework; Sustainable development

Ⅰ. Introduction

1.1 Background and Purpose of the Study

With the development of human science and technology, environmental issues have gradually taken an important position in various countries. Especially the ocean which occupies 71.8% of the earth's surface is even more seriously plagued by pollution problems. In China, the ocean area accounts for about one-third of the land area, and marine environmental protection has hence gradually become a hot topic. On 1st April 2000, China began to implement the Marine Environment Protection Law of the People's Republic of China which has so far undergone five revisions. Evidently, China is working dedicatedly with the world to cope with marine pollution.

In order to improve and protect the marine environment, China has enacted a series of laws and regulations on the prevention and control of marine pollution in such a way that could conserve marine resources, prevent and control pollution as well as damage, maintain ecological balance, safeguard human health, and promote sustainable economic and social development.

At present, the research topics on the marine pollution of most domestic

scholars can be divided into the following categories: the concept definition of marine pollutants; the causes of marine pollutants; the harm of marine pollution; the legal research on marine pollution (issues related to China's current legal system and international legal system for the treatment of marine pollution in China); and marine pollution problems and so on. Less attention has been put so far on studying the marine pollution institutions.

To fill in the current literature gap, this article analyzes and elaborates on the seven basic elements of China's current marine pollution response institutions based on the IAD framework, points out the deficiencies more systematically and suggests the possible improvement measures of China's current marine pollution response institutions.

With the deepening of China's system reform, many old institutional forms need to be eliminated or changed so as to assist the government in better designing the top level of the marine environmental protection system as well as allocating appropriate proportion of the rights of the central government and local governments. Thus, the study of the marine environmental protection system is necessary as it has important constructive significance for the reform of China's marine protection system.

Following aforementioned, this study aims to analyze the causal relationship between marine pollution response institutions used in China and sustainability of ocean from the perspective of new institutionalism. That is, this study tries to analyze the effect of Chinese marine pollution response institutions on the ocean sustainability using new institutionalism approach. And based on the analysis, this study suggests some improvements for marine pollution response institutions.

1.2 Scope of the Study

This study has stared off with the background and purposes of this research to give readers the contemporary picture of China's effort on marine pollution issues. China has been an active nation in combating marine pollution but there is a literature gap which needs to be fulfilled with the past of time. Hence, this study serves to provide more insights by analysing the seven basic elements of China's current marine pollution response institutions ,and stating the effects of Chinese marine pollution response institutions on the ocean sustainability using new institutionalism approach, as well as suggesting relevant improvements which could be made.

Institutions involved in this study refers to law or rules and organizations of marine pollution response. Meanwhile, marine pollution issue being discussed is mainly focused on the pollution due to oil spill from the ship.

Chapter II provides literature review on previous research, new institutionalism concept and analytical framework. Chapter IV researches about the system of marine pollution response. Next, Chapter V analyses the current situations of institutions, their interactions and how has it influenced the sustainability of environment; while chapter VI suggests relevant improvements which could be made to enhance the passion of all institution in moving towards ultimate goal of achieving sustainable marine environment.

Ⅱ. Literature Review and Analytical Framework

2.1 New Institutionalism

2.1.1 An Overview of New Institutionalism

The new institutionalism theory was founded in the 1970s by American economic historian Douglas North and others. He first introduced institutional factors into the study of economic history and discovered the role of institution as well as institutional changes in long-term economic growth and stagnation. He then, established an analytical framework and methodology for the new institutional economics of "institution—selection—economic and social outcomes" (Douglas North,1970)

This theory and method were applied to many fields such as political science and sociology in the 1980s. "New institutionalism: organizational factors in political life" by Stanford University's James G. March and Johan P. Olsen of the University of Bergen is regarded by some Western politicians as "the most important work in recent years." Consequently, new institutionalism political science has become a new political theory after Western behaviorism politics.(James G. March and Johan P. Olsen, 1984)

The new institutionalism theory is based on the combination of traditional political science and behaviorist political science. It has undergone a development process of rise, use, summarization and reflection. On top of that, there have been 3 changes in the perspective of research as well, which is from the system itself to the individual relationship as a political subject and lastly, the history of the development of political science.

In details, the original interaction between people and institutions in the ancient Greek city-state politics had first transformed into the concept of human being the passive acceptor of the system in the medieval theological politics. Then it switches to the emphasis of leading role of an individual in the design of system in modern political view; and finally, the reflection of the system and rethinking of institutional as well as individual relations in post-modern political science. As a sum, the relationship between individuals and institutions is a multi-dimensional and three-dimensional benign interaction after undergoing the three main transformations. A clear understanding of this relationship could definitely help individuals play a better role in political life.

In 1984, March and Olson published "The Theoretical Core of the New Institutionalism," pointing out that organizations that are fundamental to political life have been ignored due to the influence of behaviorism despite organizations and legal systems have become the dominant players in political

life. On top of that, there is a gap between the individual's "expressed" preference and the true preference. Specifically, collective decision-making is not the result of individual preference aggregation but the product of decision-making rules. Meanwhile, the collective decision-making cannot be reduced to individual preference as well. Consequently, they proposed to look at political life from the perspective of "new institutionalism" and re-revive the role of institutional analysis. In the field of political science, the rise of new institutionalism is inseparable from the criticism of behaviorist theory. New institutionalists believe that abandoning the study of institutions is a major flaw in behaviorism. "New institutionalism strongly opposes the identification of behavior as a fundamental element of political analysis; they do not believe that behavior can provide an adequate basis for the interpretation of 'all government phenomena'. However, as behavior occurs in an institutional environment, institutional factors must be considered when understanding this concept.(March and Olson,1984)

Since the 1990s, the new institutionalism analytical paradigm has become a path of analysis that transcends a single discipline, spanning economics, political science, sociology, and even the entire social sciences. Howell and

Taylor believe that there are at least three different new institutionalism in political science, namely, “historical institutionalism, rational choice institutionalism, and sociological institutionalism“(Peter A. Hall, Rosemary C. R. Taylor, 1996:936-957). American scholar Peters also summed up the various schools of the new institutionalism analytical paradigm: normative institutionalism, rational choice institutionalism, historical institutionalism, empirical institutionalism, sociological institutionalism, interest representationism, and international institutionalism(B. Guy Peters, 1999). These institutional studies of different disciplines and different schools have jointly constructed the theoretical system of new institutionalism. Among them, the most influential are sociological institutionalism, rational choice institutionalism, historical institutionalism， and normative institutionalism.

Sue E. S. Crawford and Elior Ostrom(1995:p582-599) believe that the institution includes three basic connotations: first, the institution is a kind of equilibrium, and the institution is a result of rational individuals’ mutual understanding of preferences and choices. It shows a steady state, and the stable behavior is the system.

Second, the institution is a norm. It believes that many of the observed

interactions are based on a common understanding of "appropriate" and "unsuitable" groups of individuals in a particular situation. This kind of understanding often goes beyond the analysis of the current means-purpose, and largely comes from a normative obligation.(Sue E. S. Crawford and Elior Ostrom, 1995)

Third, the institution is a rule. It believes that interaction is based on a common understanding and that if it is not followed, it will be punished or inefficient. (Sue E. S. Crawford and Elior Ostrom, 1995)

In short, the system is a rule, which can be either formal or informal. The rules basically indicate a two-way interaction constraint, the system is the result of human behavior, but human behavior is also bounded by the system. Macro-level rules include property rights, contracts, bureaucracy, and constitutional rules, and so on. Micro-level rules include norms, work procedures, instructions, disciplines, and etc. that exist in social groups and interpersonal relationships. As illustration, an institution is an organization; while family, enterprises, trade unions, political parties, etc. are systems. Institutions are a universal form of civil society that forms the basis of a modern state; while the long-standing cognitive networks such as concept or

culture, values, habits and customs are systems which provide a meaningful framework for human behavior and constrain human behavior. The rules, norms, and procedures used by modern organizations are a form of practice for a particular culture. Many of these forms and procedures should be regarded as a concrete practice model of culture, similar to the myths and rituals designed in some societies. To a certain extent, they are the result of a series of process models associated with the spread of cultural practice patterns. Even organizations that appear to have the most bureaucratic characteristics in appearance must be explained in cultural terms. (Ostrom, 1996)

After the introduction of new institutional economics into China, Chinese political scholars were greatly encouraged, and then introduced the theory of the Ostrom couple, another branch of rational choice institutionalism. The theory of the Ostrom couple has a special title in the American political sciences - Institutional rational choice (IRC), which is especially used in policy research.

Vincent Ostrom's "Introspection of Institutional Analysis and Development" was translated and republished several times in 1992. His "Political Theory of

Compound Republicanism“（1996）and “Ideological Crisis of American Public Administration“（1999）were also translated.

Elinor Ostrom’s book “The Governance of Public Affairs - The Evolution of Collective Action Systems“（2000）and “Institutional Construction of Public Services - The System Structure of Urban Police Services“（2000）was also translated and received the most attention of the academic community.

2.1.2 IAD Framework

The IAD framework was first proposed in 1982, and is an important theoretical framework in the field of public administration and policy research, also, IAD framework is one type of the new institutionalism. The purpose of this framework is to integrate many incentives and corresponding behaviors faced by politicians, economists, anthropologists, social psychologists and other individuals who have an impact on the system through a universal framework.(Ostrom,1999:46)

The Institutional Analysis and Development (IAD) framework was developed by a group of scholars at the workshop in Political Theory and Policy Analysis at Indiana University, led by the Ostrom， and developed decades ago.(Ostrom,1999:46)

Ostrom has distinguished the differences between institutional frameworks, theories and models. She thought the development and use of a general framework helps to identify the elements (and the relationships among these elements) that one needs to consider for institutional analysis. The development and use of theories enable the analyst to specify which components of a framework are relevant for certain kinds of questions and to make broad working assumptions about these elements. The development and use of models make precise assumptions about a limited set of parameters and variables. Logic, mathematics, game theory models, experimentation and simulation, and other means are used to explore the consequences of these assumptions systematically on a limited set of outcomes. (Ostrom,1999)

The IAD framework of the Ostrom consists of three basic parts: exogenous variables, action arena, and evaluation criteria. From this three basic parts there are 7 rules: position rules, boundary rules, choice rules, aggregation rules, information rules, payoff rules and scope rules. These 7 Rules correspond to 7 elements respectively (positions, participants, actions, control, information, benefits, potential outcomes. These 7 elements operate in three basic parts, forming a complete IAD framework.

The IAD framework created by Ostrom seeks commonality in different institutional systems. In other words, to judge whether an institutional system

is a mature and complete institutional system, the system must have three basic structures in the IAD framework: exogenous variables, action arena, evaluation results, and must have 7 basic elements (positions, participants, actions, control, information, benefits, potential outcomes). The 7 basic elements can be influenced by position rules, boundary rules, choice rules, aggregation rules, information rules, payoff rules and scope rules, and they have mutual influence, stimulation and operation to each other.

Therefore, the Chapter IV of this study will elaborate on the corresponding relationship between the seven elements and the 7 rules in China's marine pollution prevention and control system, and how they operate in the three major parts.

2.2 Prior Research

In the 1940s, a standard tanker with a load capacity of 16,400 has appeared in international transport. In the same time , the problem of marine pollution caused by the oil spills from the ship came to the surface and gradually gained the attention of all countries. "The International Convention for the Prevention of Marine Oil Pollution", promulgated in 1954, which is the first convention to prevent ships from polluting the marine environment. In 1969,

"The International Convention on Intervention of Oil Pollution Accidents on the High Seas" was introduced in 1969. In 1990, the US government enacted a stricter oil pollution prevention bill, "The Oil Pollution Act of 1990". In the same year, the International Maritime Organization developed and adopted the "1990 International Convention on Oil Pollution Preparedness, Response and Cooperation."

China's research on the oil spill response system started late. In 1999, the Law of "Marine Environment Protection Law of the People's Republic of China" was amended. The law was implemented on April 1, 2000. In 2009, the State Council issued a new "Regulation on the Prevention and Cure of Marine Pollution by the Marine Environment". On February 1, 2012, the "Regulations on the Investigation and Handling of Marine Ship Pollution Accidents in the People's Republic of China" was implemented to regulate the investigation and handling of ship pollution accidents. The Inter-Ministerial Joint Meeting of the National Major Maritime Oil Spill Response Office reviewed and approved the "National Major Maritime Oil Spill Emergency Disposal Plan", which was issued on March 8, 2018.

Judging from the current research status of China, the academic community has made certain achievements in the study of the Marine Environmental Protection Law. From the time of publication of such research articles and

works, most of them were published in 2000, after the revision of the Marine Environmental Protection Law, and the number of publications increased year by year, reflecting that China's marine environmental protection work has paid more and more attention, and great progress has been made in all aspects. For example, in "Kangfei Oil Spill Accident: Reflections on the Legal Mechanisms of Marine Environmental Protection", Wang Canfa and Huang jing (2011:36-39) focus on introspecting the implementation mechanism of the law.

In Song Xuming's "Defects in china's marine protection law and its improvement: a case study of the oil — leak incident of Bohai Bay"(2011) and Shi qiwen's(2010)" Seeing the Perfection of the Legal Liability System of Marine Environmental Protection in China from the Oil Spill Case in Bohai Bay"(Song Xuming, 2011：p46-53), focus on the defects of the legal liability system.

The current domestic research on marine pollution caused by oil spills, mainly focusing on the following points.

1) Definition of marine pollutants

Wei Jingjian (1996) put forward that marine oil pollution refers to the pollution of marine environment caused by oil cargo, fuel oil or other oil substances spilled or discharged from ships or other marine installations when

they are in normal operation or when accidents occur.

2） Causes of marine pollutants

Zhang Jiping, Zhao Xiafei and Li Qianghua (2018) marine oil spill pollution accident caused serious harm to the marine environment, and the accident was mainly caused by unsafe acts of human factors. Through the analysis of oil spill pollution accidents on ships, they found that the main unsafe behaviors of seafarers were errors in operation of loading oil, irregular operation in navigation and improper operation of unloading oil. The reasons were that the supervision of maritime agencies was not strict, the management of shipping companies was not in place, and the training quality of seafarers was neglected by educational and training institutions, which ultimately led to the unsafe behavior of seafarers. To rectify the unsafe behavior of seafarers, it is necessary to strengthen the supervision and management of maritime agencies, strengthen the management of shipping companies to seafarers and improve the quality of training for seafarers by educational and training institutions, so as to reduce the occurrence of unsafe behavior of seafarers and ensure the safety of ships.

3） Marine pollution hazards

Cheng Linqing, Zhao Peng, Ma Yue and Wang Fang (2018) pointed out that when oil enters the ocean, on the one hand, it will pollute marine living

resources; on the other hand, it will pollute the marine environment. Oil spills on the sea will lead to a decrease in the rate of oxygen exchange between the atmosphere and sea water, resulting in the imbalance of the marine ecological environment, thus greatly reducing the productivity of the ocean.

Oil stays in water for a long time, and the converted aromatic hydrocarbon compound will gradually accumulate in the body of marine organisms, and eventually enter the human body through the use or consumption of marine organisms, which seriously endangers human health and safety. Oil sunk to the seabed will have a negative impact on the normal production of seabed organisms. After microbial decomposition, some of the oil sunk to the seabed will rise to the surface and continue to affect the ecological balance of the ocean.

4） Study on marine pollution legal system

Ding Jianhong (2005) believed that international organizations and western developed countries had established relevant conventions or regulations on oil pollution prevention and control to prevent the further deterioration of the marine environment, but China's ship oil pollution prevention and control system had not yet formed, and proposed that China needed a set of ship oil pollution prevention and control system in line with its National conditions. For example, more efforts should be made to implement the legal provisions,

increase pollution charges, increase the collection of anti-pollution deposits for ships before departure, establish a complete compensation mechanism for oil pollution damage, set up a fund for oil pollution prevention and control, and improve the mechanism of oil pollution insurance to introduce reinsurance mechanism.

Jin Shan (2014) analyzed the necessity and urgency of legal response of oil spill pollution in marine engineering by analyzing the oil spill accidents in the US Gulf of Mexico and China's Kangfei oil spill accidents in the past five years. In view of the shortcomings of China's marine engineering oil pollution prevention and control legal system, it is proposed to improve the marine industry oil pollution prevention legislation, build a marine engineering oil pollution prevention and emergency rescue system, and improve the marine engineering oil pollution compensation legal system and other specific countermeasures.

Zhai Yaning (2015) through the analysis of the international legal rules system for oil pollution at sea and the legal practice of the United States and Canada, comprehensively the current situation of Chinese law, and proposed that China can learn from the United States to introduce the "oil pollution law" to systematically regulate the legal prevention and control of oil pollution at sea. The National Law on Compensation for Compensation for Ocean

Ecological Damage and Losses recommends that China learn from Canada's two-tier compensation fund system. Now it has established a compensation fund system in the country and will join the Fund Convention after certain development.

Ni Guojiang, Sun Mingliang, Wen Yan (2015) proposed that the scope of compensation for oil pollution damages stipulated in China's Marine Environmental Protection Law is too narrow, and the environmental capacity damage, marine biodiversity damage, marine ecology should be based on actual conditions. Factors such as damage to service functions, coastal tourism and other coastal industry damages are included in the scope of compensation, and appropriate penalties are determined. Promote the prevention and control of oil spills by improving economic penalties.

5） Problems of China's marine pollution

Han Junsong (2011) analyzed the shortcomings of the prevention and control of oil spill accident at sea in China through the case study of "7.16" accident in Dalian New Port. Including problems in planning and construction of large oil ports and oil storage areas, lack of a unified emergency response mechanism for oil spill, insufficient emergency preparedness, relatively backward cleaning technology means, and imperfect claim mechanism.

6） Research on China's marine oil spill emergency

Wu Zhidan(2013) pointed out in the "Analysis of Emergency Management Mechanism of Sudden Ecological Crisis Based on Regional Collaboration" that the 4R model based on emergency management proposes four aspects from joint monitoring and early warning, integrated material reserve, cooperative decision aid and joint assessment. In the case of sudden cross-regional ecological crisis, a way to build an emergency management mechanism based on regional cooperation is established.

2.3 Analytical Framework

In the first part of the Chapter II, the IAD framework is mainly composed of three basic parts: exogenous variables, action arena and outcomes. The exogenous variables include biophysical/material conditions, attributes of community and rules. Action arena includes action situations and participants. Participants follow the rules of exogenous variables and other basic conditions, and the outcomes produced by interaction are taken as evaluative criteria.

2.3.1 Exogenous Variables

Regarding natural material conditions, Ostrom classifies them as

biological/material conditions. Ostrom, influenced by Tocqueville, formulated the exogenous variable part of the IAD framework. Tocqueville proposed three reasons for helping the United States maintain democratic and Republican system, which can be summarized as follows: First, God's unique and fortunate geographical environment for Americans; Second, the rule of law; Third, habits and customs. Among these three, Tocqueville believes that the people's conditions are the most important, followed by the legal system and geographical environment.(Tocqueville,1935) Ostrom refined Tocqueville's idea of geographic environment into one of the three main factors affecting exogenous variables, namely, biological/material conditions. (Ostrom,1996)

Common-pool resources are non-exclusive and competitive items. They are common resources that people use the entire resource system but enjoy the resource units separately. As Ostrom thought "Common-pool resources are public resources in which people use the entire resource system together but enjoy the resource units separately. In this resource environment, a rational individual may lead to problems of resource use congestion or resource degradation." (Ostrom 1996) Ostrom gives four categories of goods, as shown in the Table 1 below.

Table 1: Four basic types of goods

	Subtractability of use		
Difficulty of excluding potential beneficiaries		Low	High
	Low	Toll goods	Private goods
	High	Public goods	Common-pool resources

Source： Ostrom, 1996, Understanding institutional diversity， p24

Common-pool resources yield benefits where beneficiaries are hard to exclude but each person's use of a resource system subtracts units of that resource from a finite total amount available for harvesting ，according to the above analysis, the biological/material conditions of the ocean belong to the category of common-pool resources.

According to the national conditions of China's marine environment, facing the marine pollution caused by oil spill, although in the area of prevention and monitoring, China has adopted satellite remote sensing technology for real-time monitoring of the sea surface, however, the marine pollution caused by oil spill can not be completely controlled and eliminated technically. The external biological environment will also be destroyed by the marine pollution

caused by oil spill. Therefore, the impact of biological/material conditions is defined as “not completely controlled“.

Ostrom mentioned that the attributes of a community that are important in affecting action arenas, include: the values of behavior generally accepted in the community (Abbreviated as “V“ in Table 2); the level of common understanding that potential participants share (or do not share) about the structure of particular types of action arenas (Abbreviated as “L“); the extent of homogeneity in the preferences of those living in a community (Abbreviated as “H“); the size and composition of the relevant community (Abbreviated as “S&C“); and the extent of inequality of basic assets among those affected (Abbreviated as “A“).(Ostrom,1996)

Boyd and Richerson （1985）; Richerson and Boyd (2002) proposes that the term “culture” is frequently applied to the values shared within a community. Culture affects the mental models that participants in a situation may share. Cultures evolve over time faster than our underlying genetic endowment can evolve. Cultures have in turn affected how the human brain itself has evolved. （Culture and the evolutionary process, p331）

The term “culture“ can be used to describe the basic attributes of the community and to express the behavioral values generally acceptable to the participants in the community. According to China’s national conditions and the

focus of this study is the response institution of marine pollution in China, which belongs to the study of common-pool resources. Therefore, I define the attributes of the community as communism in this study.

Table 2: The attributes of a community in the arena of marine pollution

	Government	Public	Polluter
V	Communism	Communism	Communism
L	High	Low	Low
H	High	Low	High
S&C	Small scale & Single	Large scale & Complex	Small scale & Complex
A	Low	High	High

2.3.2 Action Arena

Action arenas include two holons: an action situation and the participant in that situation (see Figure 1 : Analytical framework).

An action situation can, in turn, be characterized using seven clusters of

variables: (1) participants (who may be either single individuals or corporate actors), (2) positions, (3) potential outcomes, (4) action-outcome linkages, (5) the control that participants exercise, (6) types of information generated, and (7) the costs and benefits assigned to actions and outcomes.(Ostrom,1996)

According to the above definition, the action situation in this study refers to the problems of marine environmental pollution caused by oil spill. Participants in this behavioral situation include government , polluters and the public.

Therefore, the IAD framework of China's marine pollution response institution should be as follows (Figure 1 : Analytical framework):

2.3.3 Outcomes: Sustainability

In 1987, the United Nations World and Environment Development Commission, chaired by Norwegian Prime Minister Gro Harlem Brundt land, published a report entitled "Our Common Future"(1987), formally putting forward the concept of sustainable development, and comprehensively discussing the issues of environment and development of common concern to mankind on this theme. Great importance has been attached to by governments and public opinions all over the world. At the 1992 United Nations Conference on Environment and Development, the essentials of sustainable development were recognized by the participants.

The definition of sustainable development theory can be summarized into

five schools, focusing on the natural ecological perspective: in November 1991, the International Ecology Association (Intecol) and the International Union of Biological Sciences (Iubs) jointly held a symposium on Sustainable development. The outcome of the seminar not only develops but also deepens the natural attributes of the concept of sustainable development, which is defined as protecting and strengthening the production and renewal capacity of environmental systems. Defining sustainable development from the concept of biosphere is a representative of defining sustainable development from the aspect of natural attributes. That is to say, sustainable development is to seek the best ecosystem to support the ecological integrity and the realization of human aspirations, so as to make the human-living environment sustainable.

The definition generally accepted by the international community is that: before 1988, the definition or concept of sustainable development had not been formally introduced into the "field of development business" of the United Nations. In 1987, the World Commission on Environment and Development, chaired by Mrs. Brundt land, defined sustainable development as "development that meets the needs of contemporary people without compromising the ability of future generations to meet their needs" (Mrs. Brundt land, 1986). In the spring of 1988, during the consultation meeting of the Committee of the Whole of the Governing Council of the United Nations Development Program, there was a heated debate between developed and

developing countries on the meaning of sustainable development. At the end of the discussion, an agreement was reached to invite the United Nations Environment Council to discuss and draft out the meaning of the term "sustainable development", which can be accepted by everyone. During the 15th session of the UNEP Governing Council, held in May 1981, the Statement on Sustainable Development was adopted after repeated consultations.

The consequences of the oil spill accident are contrary to the theory of sustainable development. Although oil spills can compensate for short-term damage through economic compensation, the medium-term and long-term impact on the marine environment is incalculable.

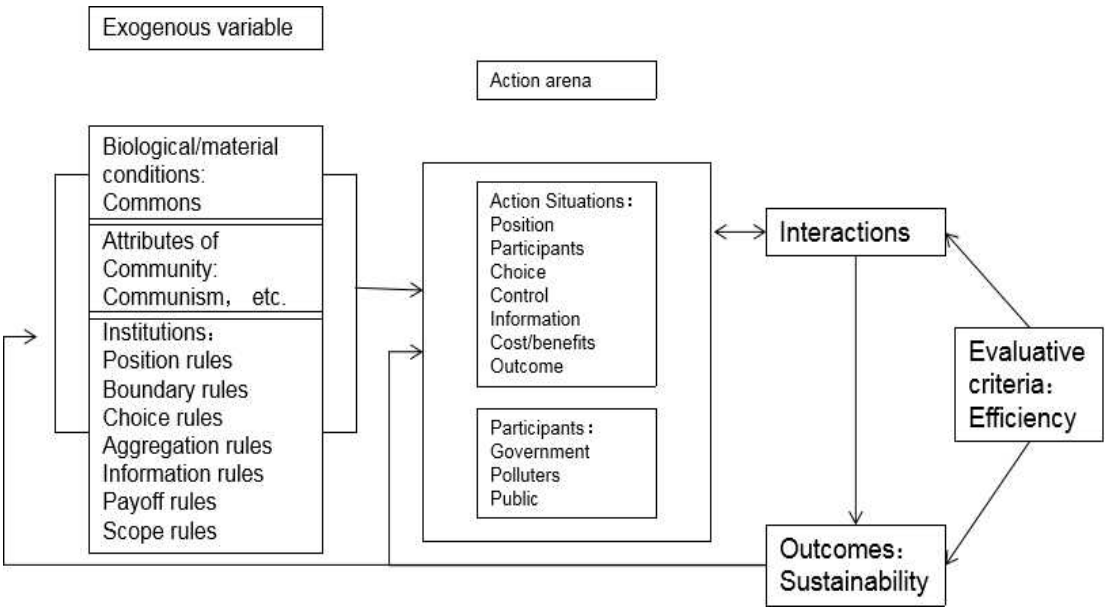
Measurable economic compensation can not only meet the needs of contemporary people for marine environmental protection, but also has an impact on the future generations.

Therefore, this study aims to improve China's marine environmental response institutions with the theoretical perspective of sustainable development, in a way to curb the occurrence of oil spills and in the event of an accidental marine accident, and reduce the environmental damage caused by marine oil spills in time.

In this study, the evaluation criterion of sustainability is efficiency, whether the ocean is used efficiently or not is very important. In the use of Chinese ocean, in order to avoid the tragedy of the commons and use it

efficiently (maximize social welfare), Chinese government should amend institutions for adjusting the new problems of Chinese marine pollution response, the details will be discussed in Chapter 5. Efficiency can not be achieved through market.

Fig. 1 : Analytical framework



Ⅲ. System of Marine Pollution Response

3.1 Marine Oil Spill Accidents and Their Damage

Oil spills will cause great harm to the marine ecological environment, human health, fisheries, tourism, etc. not only in terms of short-term impact on the lives and environment of the people, but also in terms of medium and long-term range of continuous destructive power.

This study collects oil spills from ships in China's waters (excluding Hong Kong, Macao, Taiwan) in the 21st year of 1990-2010, with a single ship oil spill of 50t or more. The accident was not limited to the leakage of petroleum pollutants, but also included seven ship accidents involving chemical spills.

Table 3: Threaten degrees of ship oil spill accidents

Year	Larger ship pollution accident		Major ship pollution accident		Especially serious ship pollution	
	Number of accidents	Total oil spill/t	Number of accidents	Total oil spill/t	Number of accidents	Total oil spill/t
1990	1	100	0	–	0	–
1991	0	–	0	–	0	–
1992	2	430	0	–	0	–
1993	0	–	0	–	0	–
1994	3	300	0	700	0	–
1995	5	1367	1	1532	0	–
1996	3	785	2	–	1	1000
1997	3	490	0	–	0	–
1998	2	392	0	1089	0	–
1999	0	–	2	–	0	–
2000	1	230	0	–	1	2000
2001	1	200	0	900	0	–
2002	4	825	1	670	0	–
2003	2	650	1	–	2	3268
2004	1	100	0	950	0	–
2005	2	571	1	–	0	–
2006	2	664	0	–	0	–
2007	2	350	0	–	0	–
2008	0	–	0	500	0	–
2009	2	532	1	–	0	–
2010	0	–	0	–	–	–
Total	36	7986	9	6341	4	6268

Source: Characteristics and prevention countermeasures of marine oil spill accidents from ship in China,(2013):875-879

From the bulletin of China's Marine disasters issued by the state oceanic administration that, during 2002-2005, the national ocean administration conducted data statistics on oil spill accidents, including the number of oil spill accidents, the number of disasters, the number of deaths caused by oil spill and the direct economic losses caused, details are shown in the table below:

Table 4: Marine oil spill accidents in China from 2002 to 2005

Year	Time	Disaster	Death	Direct economic losses (Hundred million)
2002	6	2	-	0.046
2003	5	-	-	0.17
2004	5	-	-	-
2005	8	-	-	-

Source: State oceanic administration

It can be seen that the short-term intuitive economic impact brought by oil spills is very large. The medium and long-term social and economic impacts are far-reaching. In the oil spill accident, the oil spill accident caused by the ship accounts for the majority, and the influence is relatively large. The system loopholes involved are also obvious. Therefore, this study will focus on the marine pollution caused by oil spills from ships, and strive to improve the

environmental protection system of the marine environment based on the IAD framework.

3.2 System of Marine Pollution Response

The laws and regulations used in this study are the current institution of marine oil spill response in China. This study lists the institutions applied within the scope of this study as follows:

1) Marine Environment Protection Law of the People's Republic of China

2) National Major Marine Oil Spill Emergency Disposal Plan

3) Regulations on the Investigation and Handling of Marine Ship Pollution Accidents in the People's Republic of China

4) National Water Traffic Safety Supervision and Rescue System Layout Program

5) Measures for Public Participation in Environmental Protection

6) List of China Marine Environmental Protection Organizations

7) Pilot Measures for the Administration of Appointed Civil Servants

8) Civil Servant Law of the People's Republic of China

In April 2007, the State Council approved the medium-term and long-term plan for the first national-level water traffic safety supervision and rescue system prepared since China's founding of the country—"National Water Traffic Safety Supervision and Rescue System Layout Program" (here in after referred to as the "Program"), this "Program" is an integral part of the national emergency public emergency response system, filling the gap in China's previous maritime traffic supervision and rescue system.

However, the form of water transportation safety in China is extremely complicated. The water activities are mainly passenger and cargo transportation. With the rapid development of waterway transportation and the increasing use of marine development, the risks and threats of water traffic safety accidents have also increased.

China's marine environmental management system has inherited the land administrative system to a certain extent. At the local level, China's marine environmental management system presents a "block" shape, which is to extend the functional departments under the coastal local government and its leadership to the ocean, and to give the coastal local governments the functions of marine environmental management. However, the relevant institutional settings, responsibilities and authorities of the local authorities are not fully connected with the types of systems in charge of the central

multi-functional departments.

Compared with the current serious situation of marine environmental problems, China's marine environmental management system of "Integration of departments and regions at different levels, Departments and regions at different levels as block-based, Decentralized management" has been unable to adapt to the current transformation of marine environmental problems.

At present, China has established an organizational system for preventing and controlling oil spills from ships.

First, this study introduce the organization and command system. At the national level, the State Council approved the establishment of the national joint inter-ministerial meeting system for the emergency response of major oil spills at sea in 2012, and established the China Maritime Search and Rescue Center, which undertakes the organization, coordination and command of major oil spills at sea. In addition, relying on local governments, the corresponding maritime search and rescue centers have been established.

In terms of hardware facilities, an oil spill emergency equipment library has been established. It has improved the ability of emergency clearance of oil spill at sea and basically achieved full coverage of key waters.

In the construction of laws and regulations, a basic full coverage of marine

oil spill emergency plan and system has been established, including ship, wharf, port, provincial, regional and national oil spill emergency plan system.

In terms of prevention, surveillance and monitoring of oil spills have been strengthened. In 2009, for the first time, China's maritime administration used satellite remote sensing technology to actively routinely monitor oil spills in the Bohai Sea and the Yellow Sea, marking that China's oil spill monitoring technology has reached the international advanced level.

In terms of human resources, the government emergency team and social emergency team have been constructed. The government emergency team refers to the marine oil spill emergency team managed and operated by the government, and the social emergency team refers to the marine oil spill removal emergency team funded by social organizations or non-governmental organizations.

Table 5: China's Current Marine Oil Spill Emergency Prevention and Control System

Organizational Command System	① Inter-ministerial Joint Meeting System for Emergency Response to Major Offshore Oil Spills ② China Maritime Rescue and Salvage Center ③ Provincial/Municipal Maritime Search and Rescue Center ④ County/Municipal/District Maritime Search and Rescue Sub-Center Sequence of work: ① → ② → ③ → ④
Hardware Facilities	Oil spill emergency equipment Depot
Laws and regulations	Emergency Plan for Oil Spill at Sea Marine Oil Spill Emergency Plan System
Prevention aspect	CCTV Radar monitoring Aviation monitoring Satellite Remote Sensing Technology Traditional cruising
Human resources	Government Emergency Response Team Social Emergency Response Team

The existing response institution basically continues the complex management system based on industry function management and integrated and coordinated management after the founding of New China. Obviously, it has been unable to meet the actual needs of “integration“ of the marine environment.

We better find out the imperfections or weaknesses of the current marine response institutions, break the Current Situation of Decentralized Management, re-integrate the system and strengthen the “integration“ management of the marine environment.

Therefore, based on the analysis and combing of the current situation and problems of China’s marine environmental management institution with the help of IAD framework, this study tries to put forward the reform direction of China’s marine environmental management institution.

IV. Analysis of the Institutions, Interactions and Sustainability

4.1 Present Conditions

4.1.1 Position Rules and Position

Position rules create positions , positions are the connecting link between participants and authorized actions.(Ostrom,1996) That is to say, the participants with the position have the right to drive behavior. Then we need to know the number of participants in a position.

The number of positions is frequently fewer than the number of participants. Depending on the structure of the situation, a participant may simultaneously occupy more than one position. Positions are thus the connecting link between participants and actions.(Ostrom,1996)

From the point of view that the participants are the public, the public have the right to supervise the government and have the obligation to protect the marine environment;

From the point of view that the participants are the polluters, the position

of the polluters is likely to cause oil spills and pollute the marine environmen t, however, the polluters must have an oil spill action to enter the polluter's position from the position of the public. Therefore, the polluters in this study refer to the participants who have caused the oil spill action;

Considering that the participants are the government, China has set up the administrative department of environmental protection under the State Council, the national maritime administrative department, the national fishery administrative department, the army's environmental protection department and the Department of the local people's government at or above the coastal county level to exercise the power of supervision and management of the marine environment for the sake of good governance of the marine environment.

Next, this study puts the analysis perspective inside the government . In order to comprehensively promote marine environmental protection policies and review important issues, the Department of Environmental Protection Administration under the State Council (SCEPAD) shall be the department that supervises and administers the entire nation's environmental protection work, shall guide, coordinate and supervise the marine environmental protection work of the whole country, and shall be responsible for the prevention and control work of marine pollution damage to the environment

by the national land-based pollutants and coastal engineering construction projects.

The National Ocean Administrative Department (NOAD) is responsible for the supervision and management of the marine environment, and organizes the investigation, supervision, surveillance, evaluation, and scientific research of the marine environment, and is responsible for the national environmental protection work for marine construction projects and ocean dumping wastes on marine pollution damage.

The National Maritime Administrative Department (NMAD) shall be responsible for the supervision and management of non-military vessels in the waters of the harbor areas under its jurisdiction and the non-fishery and non-military ships outside the waters of the harbors, and shall be responsible for the investigation and handling of pollution accidents; The inspection and handling of pollution incidents caused by foreign-related vessels sailing, berthing and operating in the sea areas under the jurisdiction of the People's Republic of China. If a ship pollution accident causes damage to the fishery, it shall involve the administrative department of fishery administration to participate in the investigation and handling.

The National Fishery Administrative Department (NFAD) shall be responsible for the supervision and management of the pollution of the

marine environment of non-military vessels in fishery waters and fishing vessels outside fishing port waters, be responsible for the protection of the ecological environment of fishery waters, and investigate and handle fisheries pollution accidents other than those specified in the preceding paragraph.

The environmental protection department of the armed forces （AEPD） shall be responsible for supervising the discharge of pollutants by military vessels and exercising surveillance over the waters of the naval ports

The environmental protection departments of the coastal provinces, autonomous regions, and municipalities directly under the Central Government （LPG）shall be responsible for organizing, coordinating, supervising and inspecting the marine environmental protection work in their respective administrative areas and shall be in charge of environmental protection against pollution damage caused by coastal construction projects and land-sourced pollutants.

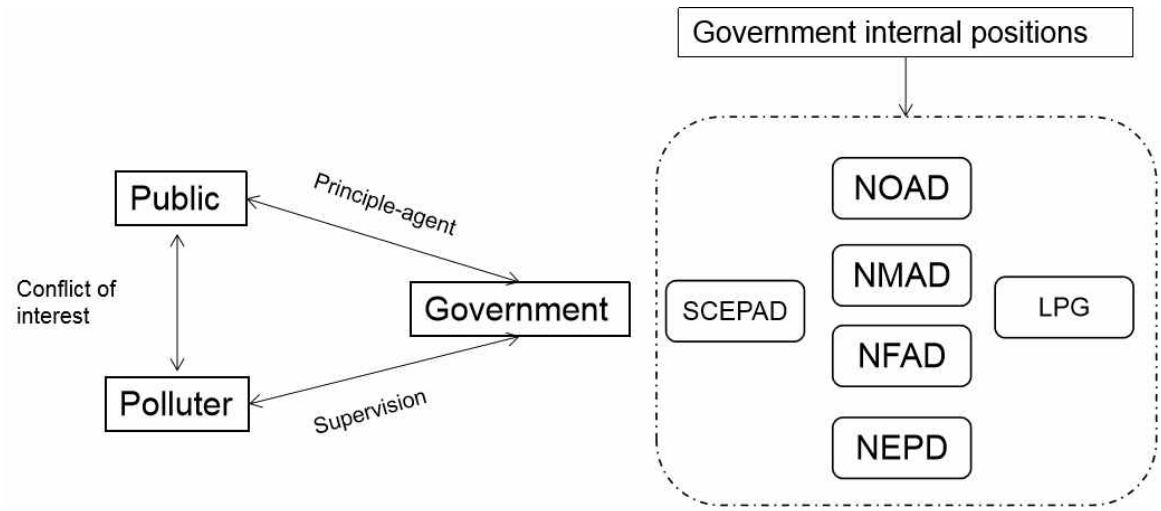
In addition, China's professional rescue and salvage team is affiliated to the Ministry of Communications. It consists of three rescue stations in Beihai, Donghai and Nanhai, a flight center and three salvage bureaus in Yantai, Shanghai and Guangzhou. It undertakes the tasks of life saving on water, fire fighting at sea, emergency response for oil spill at sea, special political and military emergency rescue, ship property rescue and sunken ships and sunken

articles salvage, etc.(Program)

In summary, according to the position rules, there are three main positions in China's marine pollution response institution, which are occupied by three main types of participants, driving their respective rights and tasks.

The three main types of participants are the public, the government and the polluters. Due to the government's structural and agent attributes, this study divides the government into six positions according to the position rules, which are respectively designated by: the Environmental Protection Administrative Department of the State Council (SCEPAD), the National Marine Administrative Department (NMAD), the National Ocean Administrative Department (NOAD), the National Fishery Administrative Department (NFAD), the Military Environmental Protection Department (NMAD), and the Maritime Department of local people's government at or above the county level (LPG) occupy the six categories of participants. The specific location rules and corresponding participants are shown in Figure 2 : Positions created by position rules in China's oil pollution response institution.

Fig 2: Positions created by position rules in China's oil pollution response institution



4.1.2 Boundary Rules and Participants

Participants, who can either be individuals or any of a wide diversity of organized entities, are assigned to positions. In these positions, they choose among actions in light of their information, the control they have over action-outcome linkages, and the benefits and costs assigned to actions and outcomes.(Ostrom,1999)

Boundary rules— frequently called entry and exit rules— define (1) who is eligible to enter a position, (2) the process that determines which eligible participants may enter (or must enter) positions, and (3) how an individual may leave (or must leave) a position.(Ostrom,1999)

Marine is a kind of common-pool resource, Ostrom identified 23 attributes of individuals and 13 conditions described by case-study authors as having been used in at least one common-pool resource somewhere in the world.(see Table 6)(Ostrom,1999)

Table 6: Attributes and conditions used in boundary rules to define who is authorized to appropriate from a common-pool resource

Attributes		Conditions
Residency or membership	**Personal characteristics**	**Relationship with resource**
National	Ascribed Age Caste Clan Class Ethnicity Gender Race	Use of specified technology
Regional	Acquired Education Skill test	Continued use of resource
Local community		Long-term rights based on Ownership of a proportion of annual flow of resource units Ownership of land Ownership of nonland asset (e.g.,berth) Ownership of shares in a private organization Ownership of a share of the resource system
Organization		Temporary use-right acquired through Auction Per-use fee Licenses Lottery Registration Seasonal fees

Source : Ostrom, 1996, Understanding institutional diversity, p224

In China, long-term rights of marine belong to the government, potential polluters can get the temporary use-rights acquired from the government.

On the action arena of marine environmental protection in China, every citizen who belongs to Chinese nationality is obliged to undertake the work of protecting the public environment, so he can become a "public" position among the participants. After withdrawing from Chinese nationality, he will lose the right to enjoy public resources in China and withdraw from the "public" position among the participants.

On the action arena of marine environmental protection in China, polluters' entry qualification is cause negative impact on China's marine environmental protection work, when eliminate the negative effects, then leave the "polluter" position.

On the action arena of marine environmental protection in China, according to China's one-party national conditions, government as one of the participants, the entry and exit mechanisms in the boundary rules can only be reflected in the internal structure of the government. Cause of the complexity of internal structure , the condition is more intricacy than the other participants.

Now, put the view into the government, a participant in a legislature could not be a member of the legislature against his or her will, but could lose this position involuntarily. In some hierarchical situations covered by civil service systems, individuals have to compete vigorously for positions by passing examinations, but once appointed, they may hold their positions for life, subject to their taking legal actions. (Ostrom,1999)

At present, the world-wide common civil service management institution can be divided into three categories: the first is the full employment institution, the job contract links the positions and participants; The second category is combination of the appointment institution and the employment institution based on the employment institution; The third category is the traditional institution that has just introduced the employment institution.

In countries such as New Zealand and Sweden, where full employment institution is adopted, all government employees are employed. The countries that have just started the employment institution include Japan, Korea, and China and so on. Article 2, paragraph 8, of the " Organic Law of the Korean Government" stipulates that "if there is a professional business, the central administrative departments can recruit and appoint civil servants for the posts designated by the President within 20% of the scope"(Korean government organization law). 'Civil Servant Law of the People's Republic of China.' has passed in 2005, for the first time, the civil service employment system was affirmed at the legal level. In 2011, the Chinese central government introduced the "Pilot Measures for the Management of Appointment Civil Servants". In 2017, the "Regulations on the Administration of Civil Servants (Trial)" was issued to improve the system of selection and employment of the employment system.

Because the servants in the departments of China's marine environmental response include two kinds of servants: the appointed civil servants and the employed civil servants. Then this study analyzes the entry mechanism and exit mechanism of the boundary rules on China's marine environmental response institutions according to the "Civil Service Law of the People's

Republic of China" and the "Regulations on the Administration of Civil Servants (Trial)".

Firstly this study discusses the entry mechanism. Entry mechanism includes examination, election and contract introduction and so on.

The Chapter 4th of the "Civil Service Law of the People's Republic of China" should use in this part to introduce the boundary rules inside the government: the civil servants without leading position adopt public examinations, strict inspections, equal campaigns, and merit-based admissions, and conduct written examinations and interviews. The institution of appointment and election shall be applied to civil servants; leading members' positions shall be governed by the term of office system in accordance with the provisions of the State. The civil servants belong to election institution shall be elected when the election results become effective.

According to "Regulations on the Administration of Civil Servants (Trial)", the positions with state secrets can not implement the employment institution. The employment of civil servants by organs includes professional and auxiliary positions. Those who engage in leading positions should belong to professional positions. The employment institution of civil servants should generally be open to the public, and the way of entry is contract employment. The basic entering process is: 1) publishing recruitment announcement; 2) enrolling and qualification examination; 3) examining and evaluating; 4) investigation and Physical Examination; 5) approving or filing; 6) going through the appointment formalities. The term of employment contract is one to five years, and the first time an employment contract is signed, a probation period of 1 to 6 months may be agreed upon; if appointed as a leading post, the

term of employment contract is three to five years, and the probation period is one year.

Then this study discusses the exit mechanism. Exist mechanism includes quit, discharge, retirement, duty exemption, expiration of contract, employment transfer to appointment and so on.

The "Civil Service Law of the People's Republic of China" should use in this part to introduce the boundary rules, Chapter 13th — Resignation and Retirement, and Chapter 14th — Retirement, refer to the exist mechanism. When a civil servant resigns from a public office, he/she shall submit a written application to the appointment and removal organ. The appointment and removal organ shall examine and approve the application within 30 days from the date of receipt of the application. Among them, the application for resignation of a leadership shall be examined and approved within 90 days from the date of receipt of the application. Civil servants holding leading posts who need to resign from their current posts due to job changes in accordance with the law shall perform resignation procedures. Civil servants holding leading positions may voluntarily offer to resign from leading positions for personal or other reasons. Leadership who have caused serious losses or bad social impact due to serious mistakes or negligence in their work or who are responsible for major accidents shall be blamed for resigning their leadership positions. If a leading member fails to resign, he shall be ordered to resign from the leading position.(Civil Servant Law in China,2018)

The discharge of civil servants shall be decided by the administrative authority. The decision of dismissal shall be notified to the dismissed civil servant on study.

Civil servants who have reached the retirement age prescribed by the State or have completely lost their ability to work shall retire.

The "Regulations on the Administration of Civil Servants (Trial)" should use in this part to introduce the boundary rules, the employment contract may be altered or terminated by mutual agreement. If the term of the employment contract expires or the termination conditions stipulated in the employment contract appear, the employment contract will be terminated immediately. For employed civil servants who perform prominently in professional posts, make remarkable achievements and contributions, and have long-term needs for their work, the term of appointment expires five years, and the annual assessment results are all above qualified or excellent. With the approval of the competent civil servant departments at or above the provincial level, they may be converted to appointed civil servants.(Regulations on the Administration of Civil Servants (Trial))

That is to say, this study summaries the entry and exit mechanisms of government Internal Personnel in the two laws as shown in Table 7：The Entry and Exit Mechanisms of Government Internal Personnel.

Table 7 : The Entry and Exit Mechanisms of Government Internal Personnel

Type	Classification	Entry Mechanisms	Exit Mechanisms
Civil servants	Non-leader	Examinations, Elections	Quit, discharge, retirement, duty exemption
	Leader	Election and Appointment	
Employment of Civil Servants	Professional/assistant	Examinations	Expiration of contract, employment transfer to appointment

Ostrom divides participants in the IAD framework into three types: individual, team status, and mixed participants. A series of participants, who have the same characteristics and have predictable co-aggregation behavior, can be considered as a class of participants. Among them, mixed participants refer to individuals who intend to create a joint product or achieve a common purpose(Ostrom,1996).

In this study, in the Chinese marine oil pollution response institution,

participants are divided into three categories: the first type of participants are composite actors, include the citizens and non-government environment protection organizations; The second type of participants are government agencies acting as agents of the public to protect the marine environment and manage the activity of marine; The third types of participants are polluters who are classified as a class of participants because of predictable co-aggregation behavior. The position and action set assigned by the three types of participants in China's marine environmental protection are shown in Table 8:

Table 8: Action sets assigned to positions in "China's marine response institutions" action situations

Position to which action set is assigned	Authorized actions included in action set
Public and NGOs	Entrust the government to handle ocean affairs and promote the sustainable development of the marine environment
Government	Improve marine environmental protection mechanisms and combat polluters
Polluters	Carry out maritime activities, which may cause marine pollution

From different perspectives, the participants in the different system are also different. The government has more control rights than the public to control the situation of marine pollution. Therefore, considering the government as an independent system, the participants in the prevention and control of marine pollution within the government are analyzed as follows:

In October 1974, the State Council Leading Group for Environmental Protection was formally established. In May 1984 (State Council No. 64), the State Council's Environmental Protection Committee was established. In June 1998 (State Council No. 5, State Council office No. 80). The National Environmental Protection Agency was promoted to the State Environmental Protection Administration (at the ministerial level) and is a subsidiary of the State Council in charge of environmental protection, and revocation of the State Council's Environmental Protection Committee. The State Council set up a ministerial department in 2008 - the Ministry of environmental protection of People's Republic of China. The Ministry of Environmental Protection (Because this department has been canceled, this part is introducing the evolution process of the department of environmental protection administration of the State Council.) is still responsible for formulating and implementing environmental protection plans, policies and standards, organizing the preparation of environmental functional zoning, supervising and managing

environmental pollution prevention, and coordinating the resolution of major environmental protection issues, as well as the formulation and implementation of environmental policies, supervision and enforcement of laws, and cross-administrative tasks such as coordination of environmental affairs in administrative regions. On March 13, 2018, the First Session of the 13th National People's Congress reviewed the reform plan of the State Council and established the Ministry of Ecology and Environment, and no longer maintained the Ministry of Environmental Protection.

The term of office of the State Council is the same as that of the National People's Congress, that is, each term is 5 years. The ministries of the State Council shall be decided by the National People's Congress in accordance with the nomination of the Premier of the State Council. During the National People' s Congress session, the Standing Committee of the National People's Congress has the power to change the other members of the State Council other than the Deputy Prime Minister and State Councilors in accordance with the nomination of the Premier of the State Council.

In the boundary rules, it is very important to identify participants and determine the number of participants.

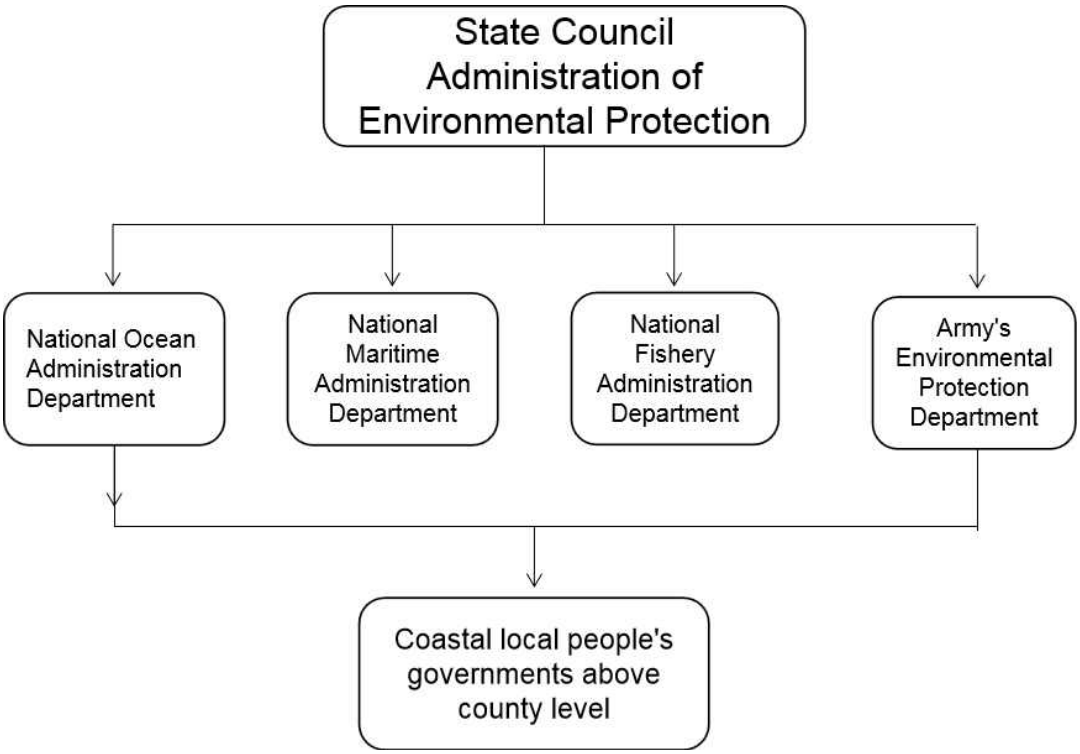
In the marine pollution response institutions, firstly there are polluters and owners whose interests are infringed upon the ocean pollution, that is, the

providers of marine use rights. The public oceans in China belong to the nationals, and private sea areas are owned by owners of the sea areas. Based on the principal-agent theory, when the private sea area is contaminated, the government is entrusted with the pollution judgment and the compensation fee is claimed. Therefore, the government is the principal of the private sea area owners. The public sea area is entrusted by the government to supervise and manage, so the government is also the principal of the public sea area.

According to the above analysis, participants in the marine pollution response institutions include polluters and government (principal identity).

The government as one part of participants, because of different department has different position, so they have different actions with different control power, the behavior of different government departments is shown in Figure 3: Government Action Process

Fig. 3 : Government Action Process



4.1.3 Choice Rules and Actions

The specific action selected by a participant from the set of authorized actions is called a choice.(Ostrom,1996)

Choice rules specify what a participant occupying a position must, must not, or may do at a particular point in a decision process in light of conditions that have, or have not , been met at that point in the process.(Ostrom,1996)

Choice rules affect the total power created in action situations and the distribution of this power. In other words, the choice rules can adjust the basic rights of the participants by expanding or narrowing the scope of action assigned to the participants.(Ostrom,1996)

The relationship between public and government is the principal — agent, the public hand over the response of the marine environment to the government, which is to empower the government to operate the marine environment. Now I put the action arena inside the government and analyze how the participants in the government participate in the response of the marine environment under the choice rules.

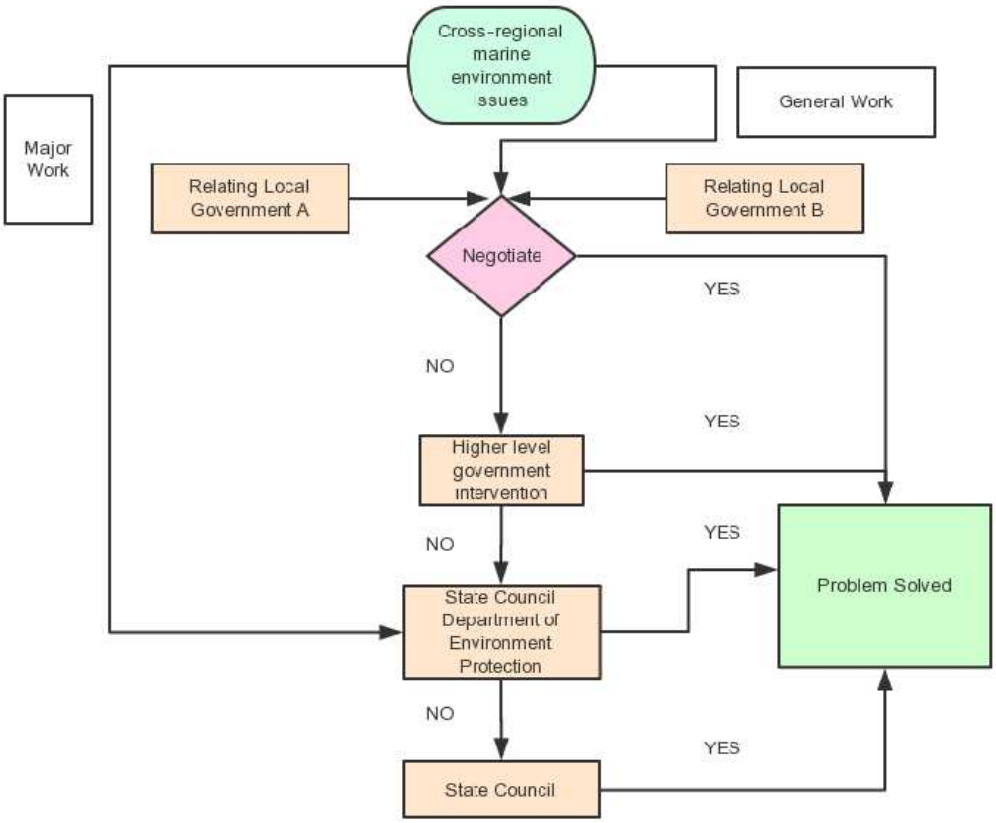
First of all, the national ocean administrative department shall formulate the national marine functional zoning according to the planning of the nation's main maritime functional areas and submit it to the State Council for approval. And then, coastal local people's governments at all levels shall then protect and scientifically and reasonably use the sea areas in accordance with

national and local marine functional zoning.

When cross-department and cross-regional marine environment-related issues arise, they are first negotiated and resolved by local people's governments or coordinated by higher-level people's governments. When cross-regional major marine environmental protection issues arise, the State Council's environmental protection administrative department is responsible for coordinating and if coordination fails to resolve, the State Council shall make a decision.

The Chinese government's division of power regarding marine environmental control affairs and the processing of oil spill accidents are shown in Figure 4： Oil spill accident treatment process.

Fig. 4 : Oil spill accident treatment process



According to the decentralization function of the choice rules, and in accordance with the Regulations in China on Investigation and Treatment of Marine Pollution Accidents, after the oil spill accident occurs, on the basis of the size of the oil spill accident, it is assigned to different departments for responsibility:

Particularly serious ship pollution accidents shall be investigated and dealt with by the State Council or the competent department of transportation under the State Council authorized by the State Council;

Major ship pollution accidents shall be investigated and dealt with by the State Maritime Administration;

Large ship pollution accidents shall be investigated and dealt with by the maritime administrative department directly under the place where the accident occurred is responsible for investigation and handling;

General ship pollution accident shall be handled by the maritime administrative agency at the place where the accident occurred.

Where a ship pollution accident causes damage to the fishery, it shall involve the fishery department to participate in the investigation and handling; If damage is caused to the waters of military ports, the relevant departments of the armed forces shall be involved in the investigation and handling. If the ship is caused by marine traffic accidents caused by marine traffic accidents,

the investigation of ship pollution accidents by the maritime administrative agency shall be conducted simultaneously with the investigation of the ship traffic accidents.

The appraisal institution engaged in the technical appraisal or testing and inspection of ship pollution accidents shall be identified by the department of transportation under the State Council.

4.1.4 Aggregation Rules and Control

Aggregation rules determine whether a decision of a single participant or of multiple participants is needed prior to an action at a node in a decision process. In the aggregation rules, it is divided into nonsymmetric aggregation rules and symmetric aggregation rules. All nonsymmetric aggregation rules treat the participants in a situation differently in regard to some decision to be made at some point in a decision process (Straffin 1977). Symmetric aggregation rules assign joint control over an action to multiple participants so that all are treated alike.(Ostrom 1999)

According to the " The Investigation and Handling of Pollution Accidents in the People's Republic of China" (here in after referred as "Regulations"),

immediately after taking an oil spill, immediately take emergency measures and report to the nearest maritime management agency. The "Regulations" define the principles for resolving jurisdictional disputes: If the place where the accident occurred is unknown, it shall be investigated and handled by the place where the accident was discovered; if it involves cross-regional areas, it shall be designated by the common superior. As mentioned in 3.1.3, this "Regulations" also defines the principle of hierarchical jurisdiction, and identifies different accident investigation agencies according to different accident levels.(Regulations 2010)

China's oil spill response institution follows the symmetrical aggregation rule and distributes the response of oil spill accidents to multiple participants, so that each participant can participate in the oil spill response institution with the same aim.

The local governments of coastal provinces, autonomous regions, and municipalities directly under the Central Government may formulate local marine environmental quality standards for items that are not specified in the national marine environmental quality standards.

The local governments at various levels in coastal areas determine the

objectives and tasks of marine environmental protection according to the standards of national and local marine environmental quality standards and the environmental quality of the coastal waters of the administrative region, and bring into the work plan of the local government and carry out management according to the corresponding marine environmental quality standards. The national ocean administrative department, together with the relevant departments of the State Council and the local governments of the coastal provinces, autonomous regions, and municipalities directly under the Central Government, formulate the national marine functional zoning and submit it to the State Council for approval in accordance with the National Plan for Marine Main Functional Areas.

Coastal local governments at all levels shall protect and scientifically and rationally use sea areas in accordance with national and local marine functional divisions.

4.1.5 Information Rules and Information

An important part of any action situations is the information available to

participants about the overall structure of that situation, the current state of individual state variables, the previous and current moves of other participants in positions, and their own past moves.

Information rules affect the level of information available to participants. Information rules authorize channels of information flow among participants, assign the obligation, permission, or prohibition to communicate to participants in positions at particular decision nodes, and the language and form in which communication will take place.(Ostrom 1999)

In information rules, it is important to establish channels of information flow, frequency and accuracy of communication, determine the subject of communication, and publish official languages. Information rules affect the level of information available in a situation about actions and the link between actions and outcomes linkages.(Ostrom 1999)

Here, this study needs to introduce the theory of information asymmetry. The theory of information asymmetry means that in the market economy activities, all kinds of personnel have different understandings of relevant information; those who have sufficient information are often in a favorable position. And the information-poor personnel are in a relatively

disadvantageous position. The theory of information asymmetry was proposed by three American economists – Joseph Stiglitz, George Akerlof and Michael Spence.(Kenneth Joseph Arrow, 1963)

The theory holds that sellers in the market know more about the various goods related to the goods than the buyer; The one who has more information can benefit from the market by delivering reliable information to the one who has less information; A party with less information among buyers and sellers will try to obtain information from the other party; Market signals show that information asymmetry can be compensated to a certain extent; information asymmetry is a drawback of the market economy. To reduce the harm of information asymmetry to the economy, the government should play a strong role in the market system.(Kenneth Joseph Arrow, 1963)

This theory provides explanations for many market phenomena such as stock market ups and downs, employment and unemployment, credit rationing, commodity promotion, and market share of commodities. It has become the core of modern information economics and is widely used in various fields, from traditional agricultural products to modern financial markets.(Kenneth Joseph Arrow, 1963)

Information asymmetry is easy to occur in the operation of information, especially in accordance with the principal-agent relationship, the government as the agent of the public, as well as the agent of the polluters, and the three types of participants are prone to produce information asymmetry in the flow of information. This problem will be analyzed in Chapter IV and put forward solutions in Chapter V.

In China's existing marine environment response system, information rules are proposed at the legal level: the relevant departments of the State Council shall provide the environmental protection administrative department of the State Council with the marine environmental monitoring data necessary for the preparation of the National Environmental Quality Bulletin.

The Department of Environmental Protection Administration shall provide relevant departments with information concerning the supervision and management of the marine environment.

In the event of an accident or other unexpected event, companies and individuals that cause or may cause accidents of marine environmental pollution, they must take effective measures immediately to inform potential victims in a timely manner , have to report to the departments exercising

the power of supervision and management of the marine environment in accordance with the regulations, and need to get investigation and treatment.

4.1.6 Payoff Rules and Costs/ Benefits

Payoff rules assign external rewards or sanctions to particular actions that have been taken or to particular readings on outcome state variables. External benefits and costs are frequently assigned to outcomes by payoff rules.(Ostrom 1999)

Payoff rules have an AIM that involves paying or receiving something of potential value. Payoff rules directly impact the net costs and benefits of action or outcomes for actors in an action situation.(Ostrom 1999)

At present, for the behavioral results of all participants involved in the Marine Environmental Protection Law of the People's Republic of China, the culpability of the deficiencies is punished according to Chapter 9 (Legal Liability) of the Marine Environmental Protection Law of the People's Republic of China, but no part of the award is involved.

In accordance with the Marine Environmental Protection Law of the People's Republic of China(MEPL), if an accident or other unexpected event causes an accident involving pollution of the marine environment and no immediate action is taken, a fine of 20,000 yuan up to 100,000 yuan shall be imposed.(MEPL 1982)

If any of the following acts occurs, the department that exercises the

authority to supervise and administer the marine environment in accordance with the provisions of this Law shall give a warning or impose a fine:(MEPL 1982)

(1) Failing to apply according to the regulations (According to Article 67 of the MEPL) or even refusing to report matters relating to the discharge of pollutants, or falsifying it in reporting;(MEPL 1982)

(2) Failure to report accidents or other unexpected incidents in accordance with regulations; (MEPL 1982)

(3) Failing to record dumping in accordance with the regulations, or failing to submit dumping reports in accordance with the regulations; (MEPL 1982)

(4) Refusal to report or lie about the declaration of the dangerous goods that have been carried by the ship.(MEPL 1982)

A person who commits any of the acts (1) and (3) of the preceding paragraph shall be imposed a fine of not more than 20,000 yuan; if he has any of the acts of (2) and (4) of the preceding paragraph, a fine of not more than 50,000 yuan shall be imposed.(MEPL 1982)

Anyone who refuses to conduct on-site inspections or falsifies while being inspected shall be warned by the department that exercises the supervision and management authority of the marine environment in accordance with the

provisions of this Law, and shall be imposed a fine of not more than 20,000 yuan.(MEPL 1982)

If the marine ecosystems such as coral reefs, mangroves and other marine ecosystems and marine aquatic resources or marine protected areas are destroyed, the departments that exercise the supervision and administration of the marine environment in accordance with the provisions of this Law shall be ordered to correct the time limit and take remedial measures, and a fine of less than ten thousand yuan and more than one hundred thousand yuan is imposed. If there is illegal income, the illegal income shall be confiscated.(MEPL 1982)

In violation of the provisions of this Law for marine oil exploration and development activities, causing marine environmental pollution, the State Department of marine administration shall give warning and impose a fine of less than twenty thousand yuan and more than two hundred thousand yuan.(MEPL 1982)

In violation of the provisions of this law, one of the following acts shall be given warning or fined by the department exercising the power of supervision and administration of marine environment in accordance with the provisions of

this law.(MEPL 1982)

(1) Ports, docks, loading and unloading stations and ships are not equipped with anti-pollution facilities or equipment;(MEPL 1982)

(2) The vessel does not hold any anti-pollution certificate or anti-pollution instrument, or fails to record the discharge record according to the provisions;

(3) Engaging in ship breaking in water areas and port areas, modification of old ships, salvage and other water and underwater construction operations, causing pollution damage to the marine environment;(MEPL 1982)

(4) The goods carried by the ship do not have the conditions for anti-fouling and proper transportation.(MEPL 1982)

A person who commits any of the acts of items (1) and (4) of the preceding paragraph shall be imposed on a fine of between 20,000 yuan and 100,000 yuan; if he has committed the item (2) of the preceding paragraph, he shall be imposed a fine of 20,000 yuan or less; Whoever commits the acts of item (3) of the preceding paragraph shall be fined between 50,000 yuan and 200,000 yuan.(MEPL 1982)

In case of violating the provisions of this Law, ships, oil platforms, and ports, terminals and loading and unloading stations for loading and unloading oils that do not formulate an oil spill contingency plan shall be warned by the department that exercises the authority over marine environment supervision and management in accordance with the provisions of this Law, or be ordered to make correction within a time limit.(MEPL 1982)

Those responsible for pollution damage to the marine environment shall eliminate the hazards and compensate for the losses; if the damage to the marine environment is caused by the intentional or negligent third party, the

damage shall be excluded by the third party and the liability for compensation shall be borne.(MEPL 1982)

Where the destruction of marine ecology, marine fishery resources, or marine protected areas has caused heavy losses to the State, the department exercising supervision and management of the marine environment in accordance with the provisions of this Law represents damages requirements for those responsible.(MEPL 1982)

For units that violate the provisions of this Law and cause marine environmental pollution accidents, except that they shall be liable for compensation according to law, the departments that exercise the authority to supervise and administer the marine environment in accordance with the provisions of this Law shall be fined in accordance with the provisions of the second paragraph of this article; The directly responsible person in charge and other directly responsible personnel may be fined for less than 50% of the income from the unit in the previous year; If the directly responsible person in charge and other directly responsible personnel belong to the national staff, they shall be given sanctions according to law.(MEPL 1982)

For those causing general or larger marine environmental pollution accidents, they shall be fined at 20% of the direct losses; those that cause major or extraordinary marine environmental pollution accidents shall be fined at 30% of the direct losses.(MEPL 1982)

Whoever severely pollutes the marine environment or destroys marine ecology and constitutes a crime shall be investigated for criminal responsibility according to law.(MEPL 1982)

If marine environmental supervision and management personnel abuse their powers, neglect their duties, engage in malpractices for personal gains, and cause pollution damage to the marine environment, they shall be given administrative sanctions in accordance with the law; if a crime is constituted, criminal responsibility shall be investigated according to law.(MEPL 1982)

The above legal liability part, involving the legal support for the polluters' pollution, and the legal punishment of the government' s internal staff for neglecting their duties, however, there is no clear participation of the public. There is no clear cost/benefit statement for the supervision or reporting of the public. This is the lack of the incentive policies mentioned above.

4.1.7 Scope Rules and Potential Outcomes

Scope rules affect a known outcome variable that must, must not, or may be affected as a result of actions taken within the situation. Scope rules define this set, affect the width of the outcome space (number of state variables affected), and specify the range on each outcome variable included in that space.(Ostrom,1999)

There are three components to what individuals value as outcomes : (Ostrom,1999)

(1) The physical results obtained as a result of a chain of actions by participants ;

(2) The material rewards or costs assigned to actions and results by payoff rules, and

(3) The valuation placed on the combination of the first and second components by the participants.

"Unintended outcomes" are also included in the outcomes, such as polluters often do not know all the physical results due to their behavior.(Ostrom,1999)

Based on the above definition, China's marine environmental response institutions currently has no scope rules.

4.2 Interactions of Participants and Problems of Institutions

4.2.1 7 Rules Affect the Interaction

It can be seen from the above analysis that China's current marine environmental response institution faces the challenge of deepening reforms, sorting out details, and clarifying the refinement of rights and responsibilities. In simple terms, this paper puts the perspective into the government department, the local government will choose to cooperate with interest groups, which is more suitable for the development of its own local economic structure, rather than forcing the polluters to introduce high-cost pollution prevention systems and cooperating with interest groups. The strategy is more suitable for the development strategy of local governments, so that the prevention and control of marine pollution cannot be effectively achieved. This problem can be effectively regulated by the choice rules and aggregation rules.

At present, the degree of disclosure of official information of the Chinese government has greatly strengthened. Under the guidance of information rules, clearing the information channels between participants has a strong help in

enhancing the government information disclosure. As the current information link is not smooth, there is not enough way for the public to obtain sufficient information about the oil spill, and it also gives the polluters a large escape space, which is not conducive to the people entering the regulatory process through the position rules.

Ostrom emphasized on the issue of the diversity of expression systems that the central government believes in the ability of local elites. In other words, it is appropriate to persuade the central government to decentralize. In the first time of the oil spill, the direct mobilization of the local Maritime Safety Administration and the participation of the local enthusiastic public will have a positive effect on the containment of oil spills, and it is difficult to control the dissemination of information. A fixed official channel for information flow should be established to allow the government and the public to move in a good direction. However, at present, the influence of official government disclosure of official channels is not expected.

Ostrom thinks the reward may be assigned strictly on action variables (e. g. how many hours the worker clocks in), strictly on outcome variables (e. g. how much of a particular final or intermediate product is produced), or on some combination of action and outcome variables (a wage plus a production bonus).(Ostrom,1996) In this study, the incentive may also be assigned strictly on action variables (e. g. how many hours the worker clocks in), strictly on outcome variables (e. g. how much of a particular final or intermediate product is produced), or on some combination of action and outcome variables (a wage plus a production bonus).

4.2.2 Importance of Incentives in Interactions

Marine pollution is becoming more and more serious, and the indelible harm caused by human misconduct needs to be curbed in time. Marine pollution caused by different sources of marine pollution is diverse. This study focuses on the response of marine pollution caused by oil spills at sea.

This study tried to analyze the China's marine pollution response institution according to the IAD framework. In the third chapter, the basic links between the main elements in the framework and the ways of mutual influence and incentive are analyzed. It is not difficult to find that if we want to form a complete framework of China's marine pollution prevention and control system, we must recognize the following issues.

(1) Participants' incentives

An incentive is something that motivates an individual to perform an action. The study of incentive structures is central to the study of all economic activities (both in terms of individual decision-making and in terms of co-operation and competition within a larger institutional structure). Therefore, economic analysis of the differences between societies (and between organizations within a society) amounts to characterizing the differences in incentive structures faced by individuals involved in these collective efforts. Incentives aim to provide value for money and contribute to organizational success. (Armstrong, Michael (2015)) As such the design of incentive systems is a key management activity. (Fehrenbacher, Dennis

D.(2013-01-01))

In this study, incentive refers to motivating the participants to complete the corresponding actions in their position and has achieved potential outcomes.

So for the participant—polluters, the relevant regulations on oil spills constrain the potential outcomes of polluters - pollution of the marine environment. The relevant regulations of the oil spill clearly point out that the possible pollution behavior must be taken in advance or preventive measures, and the compensation system after the oil spill is clearly stipulated. For example, article 65 of the Marine Environment Protection Law of the People's Republic of China(MEPL) stipulates that the ship should abide by the laws and regulations of maritime traffic safety, prevent the beach accidents caused by collision, reef, grounding, fire or explosion, and cause the pollution of the marine environment. Article 66 of the MEPL stipulate that the state has perfected and implemented the system of civil liability for compensation for oil pollution damage of ships, and established the system of oil pollution insurance and oil pollution damage compensation fund in accordance with the principle of the joint venture between the ship-owner and the owner of the ship's oil pollution damage liability.

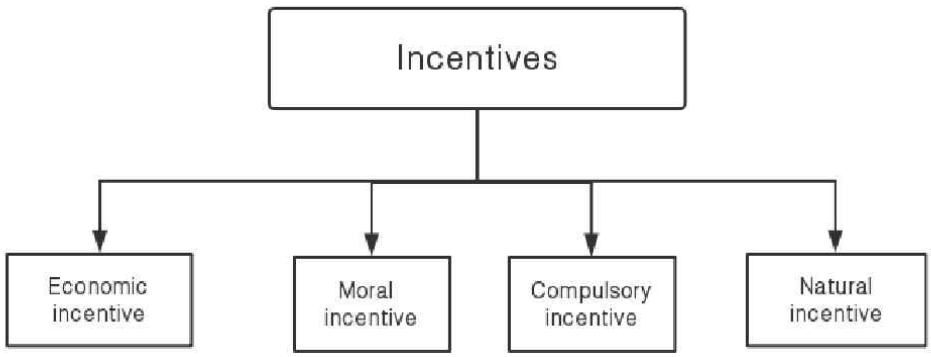
For the participant—government, the relevant regulations on oil spills constrain the potential outcomes of government - response of the marine environment. The relevant regulations for oil spills clearly stated that the government must strictly protect the marine environment.

For the participant—the public, has the obligation to protect the marine environment and the right to supervise the government. Article 4 of the MEPL: All companies/groups and individuals have the obligation to protect the marine environment, and have the right to supervise and report violations of the lawlessness of companies/groups and individuals that pollute the marine

environment, and marine environmental supervision and management personnel. Article 93: if the marine environmental supervision and management personnel abuse their powers, neglect their duties, engage in malpractices for personal gains, and cause pollution damage to the marine environment, they shall be given administrative sanctions in accordance with the law; if a crime is constituted, criminal responsibility shall be investigated according to law.

Incentives can be classified according to the different ways in which they motivate agents to take a particular course of action. At present, incentives are divided into four types: economic incentives, moral incentives, compulsory incentives and natural incentives. (Dalkir, Kimiz (2013))

Fig.5: The type of incentives



From the above analysis, we can see that in China, the main incentive of oil spill related policies is to rely on laws and regulations to conduct compulsory regulation, that is to say, it belongs to compulsory incentive, and

the law stipulates that the fines for the corresponding pollution are financial incentives and compulsory incentives. How to fully mobilize moral incentives and natural incentives? And how to enrich financial incentives and compulsory incentives? These two questions will be mentioned later.

According to the IAD framework, participants have a direct relationship with position rules, that is, where they are to fulfill their responsibilities and obligations. If we want to maximize the enthusiasm of participants, we should work hard in the incentive link, and here we can put forward three small problems.

1) Polluters' incentives

Polluter as one of the participants, if the economic or criminal losses caused by pollution are within the scope of their profits, the polluter will not reduce his pollution behavior, or focus more on the pollution behavior before it occurs, because additional investment in behavior will increase his own cost. Therefore, too little punishment for polluters polluting the marine environment has become a problem affecting the incentives of participants.

2) Government's incentives

Government as one of the participants, the government has formed a relationship between the agent and the client with the public, that is to say, the government implements the system of marine environmental protection on behalf of the public.

The issue of salary and penalties has become one of the factors that influence the enthusiasm of government participation. Incentives include incentives and punishments, and incentive incentives affecting the implementation of government affairs include spiritual incentives and material incentives. According to Article 48 of the Civil Servants Law of the People's Republic of China, "Reward adheres to the principle of combining spiritual reward with material reward and giving priority to spiritual reward". The award grade is divided into "commendation, third-class merit, second-class merit, first-class merit and honorary title". The awarded civil servants or the collective civil servants are commended (spiritual award) and given one-time bonus or other treatment (material award).

For spiritual incentives, there is little difference between different places. For material incentives, there is no unified standard. This standard does not mean the same amount of money, but a unified norm.

Disciplinary incentives affecting the implementation of government affairs refer to sanctions. Civil servants should bear disciplinary responsibility for violations of laws and regulations. According to the Civil Servants Law of the People's Republic of China, sanctions are classified as "warning, record, record major faults, demotion, dismissal, dismissal". The period of punishment is: warning— six months; record— twelve months; record major faults— eighteen months; demotion and dismissal— twenty-four months.

China's civil servants' wages are divided into 27 grades. The basic wages in different regions have little difference, but the allowances and bonuses in different regions are quite different. There is no performance pay in the wage system, which can not reflect the difference of income distribution

among staff in different positions. The huge incentive role that salary should play as material incentive has not been reflected [27]. The main core of the incentive system is on the spiritual level, which makes the civil servants with weak sense of responsibility not only unable to exert their ability to innovate in their work posts, but also passively idle in their work and be satisfied with the status quo, thus affecting the civil servants with original sense of responsibility.

Lack of legal support is another factor affecting the enthusiasm of government participation. There are many problems in becoming an incentive mechanism for Chinese civil servants. Even among different departments, there are the same problems. The salary problems mentioned above and the relatively low punishment are typical common problems. Because the marine pollution caused by oil spill accident is a sudden problem, the timeliness of marine environmental protection in China caused by oil spill accident is a key link.

On March 20, 2018, the Ministry of Transport of China issued the National Emergency Response "National Major Marine Oil Spill Emergency Disposal Plan" (here in after referred to as the "Plan"), which has become the legal and regulatory framework adopted by China at the national level on the issue of oil spill emergency at the level of rule of law.

In the "Plan" major oil spills in China refer to:

(1) The areas where oil spills are expected to exceed 500 tons and may be polluted are located in sensitive areas; they may cause significant international impacts; or they may cause significant social impacts;(Plan,2018)

(2) It is estimated that the oil spill will exceed 1000 tons.;(Plan,2018)

The incentive part in the "Plan" is the reward and punishment mechanism in the fourth section of the fifth part. Referring to "in accordance with the relevant provisions, advanced collectives and individuals who have made outstanding contributions to the emergency disposal of offshore oil spills shall be commended; Personnel or units who neglect their duties, falsely report or refuse to execute emergency command orders in the emergency work of oil spill at sea shall be investigated for their responsibilities according to law; those who constitute crimes shall be investigated for their criminal responsibilities; Compensation or retribution shall be made to the injured and sacrificed persons in accordance with the relevant provisions.

The incentive part of the "Plan" is the only rule to follow in the marine environment response institution caused by oil spill. However, because the "Plan" is aimed at major oil spills at the sea and does not apply to all oil spills accidents, the lack of law has also become one of the reasons affecting the government's participation.

3) Public's enthusiasm

Public as one of the participants, the public has the obligation to protect the marine environment and the right to supervise the government's actions. Among the three participants, the participation of the public is the weakest.

The openness and transparency of the government's affairs directly affect the degree of public participation, and government transparency is the weak link of the current Chinese government. In 2016, the General Office of the

Central Committee of the Communist Party of China and the General Office of the State Council issued "Opinions on Promoting Government Openness in an All-round Way" and deployed it to promote it in an all-round way. Administrative organs at all levels shall be open to government affairs. Therefore, the government's disclosure of information on the process of dealing with oil spills has become the first issue affecting the enthusiasm of public participation.

The second problem is the lack of civil power. There are a large number of NGOs in China. According to incomplete statistics, they have exceeded 3500 (2015) and several powerful and large-scale environmental NGOs have made contributions to many large-scale environmental protection issues in China, such as the Kunyu River Incident in 2002, the Nujiang River Incident in 2003, the Yuanming Yuan Incident in 2005, and so on.

Especially the controversy over Nujiang hydro-power, involving local governments, central ministries, power enterprises, experts and non-governmental environmental protection organizations, has attracted intensive attention from the media at home and abroad. Finally, the controversy ended with Premier Wen Jiabao's instructions to suspend construction. Wang Ming, director of the NGO Institute of Tsinghua University, said frankly that the personal charm and intimate relationship between government officials and NGO leaders is an important prerequisite for smooth cooperation between the two sides. "Because of their activities, this platform is meaningful."

That is to say, although China's environmental NGOs represent the strength of the public, they still have to rely on the government, or rely on interest

groups, and can not play a good role in the strength of non-governmental organizations to voice for the public.

The third reason that affects the enthusiasm of the public is also inseparable from the incentive factors. Under such circumstances, the disclosure of polluters' polluting behavior and the supervision of government's behavior are not enthusiastic.

4.2.3 Coordination of Participants

(1) Internal coordination of government

According to the aggregation rules of the 7 basic rules in the IAD framework, when an oil spill occurs, the treatment nodes of marine environment pollution caused by the oil spill need to be solved by multi-participants. For the government, all departments responsible for oil spill accidents need to operate in a coordinated manner. However, from the position part, China has granted the jurisdiction of marine oil pollution control to the marine, maritime and fishery departments. Although clearly defined the scope of each department to deal with, but the oil spill accident generally triggers a number of damage at the same time, separate leadership of pollution within their jurisdiction will encounter overlapping jurisdiction, dispute over the handling of the accident, will also encounter problems of mutual prevarication. Moreover, after the oil spill, there will be no one to ask for help in the gray areas which are not within the jurisdiction of various departments. All of these problems will affect the coordination of government departments' participation.

(2) Coordination between government and pollution incident handling

According to the payoff rules in the 7 basic rules of IAD framework, when oil spill happens at sea, the ultimate punishment for the polluter will fall on economic punishment and criminal punishment. It needs legal support to coordinate the economic compensation of the polluter to the state and the public. At present, China is committed to building a trinity model of oil spill emergency management, which includes prevention, emergency response and compensation. There are also relevant provisions on "claim and compensation" in China's Marine Oil Spill Emergency Plan, which stipulates that "The compensation and claims for oil pollution damage shall be implemented in accordance with the Civil Liability Convention and the specific measures such as the ship insurance and oil pollution damage compensation fund system prescribed by the State Council."However, the relevant claiming rules have not been promulgated accordingly, and the claim mechanism for ecological damage has not been established. This has seriously affected the progress of the completion of claims after the oil spill at sea, and also has no basis for the claim behavior.

(3) Coordination between the government and the public

According to the information rules of the 7 basic rules in the IAD framework, the overall structure of the oil spill accident should be provided to all participants after the accident occurs. The timely publication and reporting of accident information by the government affects the participation of the public in the oil spill accident and the trust of the government. In other words, the coordination between the government and the public is affected.

From the “7.16 Incident“ (2010) leaking from the Dalian oil pipeline(He Yixiong, Li Jia, Zhang Yu, Mu Xiaoyun,2016:99-107), it can be seen that after the oil spill occurred, the government did not promptly report the accident through the media and did not disclose the information to the public. The public was informed of the seriousness of the accident from various private channels, which caused public dissatisfaction and condemnation of the government.

This seriously exposes the Chinese government’s lag in the disclosure of marine pollution accidents, leading to a break-up between the public and the government. After the oil spill, the social forces cannot be fully utilized for emergency rescue and the effective information flows cannot be fully utilized for dissemination of knowledge about oil pollution response to the public. It exposed the problem of coordination between the government and the public caused by incomplete information flow construction.

Table 9: Summary of institutional problems

Problems	Contents	Details
Participants' incentives	Polluters' incentives	Too little punishment for polluters polluting the marine environment has become a problem affecting the incentives of participants
	Government 's incentives	The issue of salary and penalties has become one of the factors that influence the enthusiasm of government participation.
		Lack of legal support is another factor affecting the enthusiasm of government participation
	Public' s incentives	The openness and transparency of the government's affairs are not enough
		Lack of civil power
		Weak incentive power
Coordination of participants	Internal coordination of government	In view of the current situation of separately regional leadership of pollution accidents, it will lead to overlapping jurisdiction, disputes over the handling of accidents, and the situation of pushing each other out when problems arise. Moreover, if the oil spill happens in the "grey zone", there will be no one to pay attention to it.
	Coordination between government and pollution incident handling	The relevant claiming rules have not been promulgated accordingly, and the claim mechanism for ecological damage has not been established. This has seriously affected the progress of the completion of claims after the oil spill at sea, and also has no basis for the claim behavior.
	Coordination between the government and the public	The lag of the Chinese government in the disclosure of information on marine pollution accidents, the incomplete construction of information flow leads to the coordination problem.

4.3 Outcomes: Sustainability

Oil is an indispensable resource for industrial development in all countries of the world and a blood of the modern economy. The earth is rich in petroleum resources in the ocean. Its total oil content is equivalent to that of land, reaching 50 million square kilometers. The potential oil-bearing sedimentary rock is about 14% of the total marine area (360 million square kilometers). Under the current situation of increasing difficulty in terrestrial oil and gas exploration and slow growth of reserves, the development of offshore oil resources has become the mainstream trend of current energy mining. The exploration and development of offshore oil has a history of more than 100 years. The world's first marine oil field was developed by the United States in 1938. After the 1970s, drilling in deep waters developed rapidly. By 2010, there are more than 800 mobile drilling units in the world, most of which are located in oil-rich areas such as the Gulf of Mexico, the Middle East and West Africa.

Since the late 1950s, China has started oil exploration and exploration and development work in the sea area. It is very prone to oil spills during operation. Since the 1970s, more than 2,200 oil spills have occurred in large and small ships, with an oil spill of more than 22,000 tons. Based on the large accident with an oil spill of more than 50 tons, there are probably more than 50 accidents. From 2008 to 2017, the operating accident rate of tankers above the portable level (with or without oil spills) almost tripled: the accident frequency increased from 0.025 to 0.066. According to the latest data from the Ministry of Land and Resources, during the recent "Eleventh Five-Year Plan" period, there were 41 oil pollution accidents involving offshore oil

exploration and development nationwide, including 22 in the South China Sea and 19 in the Bohai Sea. It can be seen that the frequency of marine oil spills caused by ships is very high.

Since 1993, China's oil imports have been on the rise. Today, 90% of China's oil imports are completed by sea-going vessels. The large increase in the volume of oil transported through the ocean has also increased the risk of marine oil spills caused by ships.

China National Oceanic Administration issued a simple "China Marine Environmental Quality Bulletin in **** year" in 2000 and 2001. With the increasing transparency of China's policy services and the increasing emphasis on the marine environment, the State Oceanic Administration of China issued a detailed "China Marine Environmental Quality Bulletin in **** year " in the year of 2013-2017.

In the " Bulletin ", the state of China's marine environment, China's marine ecological conditions, the status of major sources of pollution into the sea, the environmental conditions of some marine functional areas (It is divided into four main areas: ocean dumping area, marine oil and gas area, seawater aquaculture area, tourism and recreation area, and the marine oil and gas area is the discussion material of this study.) , the state of marine environmental disasters and the status of ocean carbon dioxide source and sink are analyzed in detail.

Due to the physical and chemical properties of petroleum itself, oil discharged into the ocean can have a serious impact on marine life. Once the petroleum hydrocarbons of various structures are absorbed by marine organisms, the properties become very stable, passing in the food chain,

circulating and no longer being decomposed. More seriously, because petroleum hydrocarbons are not decomposed, they are enriched by the food chain, making the concentration of petroleum hydrocarbons in the high-end marine organisms of the food chain higher and higher. Petroleum-poisoned toxic substances enter the economic fish, shrimp, shellfish, and algae that people eat through the food chain. Eventually, they will bring long-acting toxic substances (such as carcinogens) from petroleum components into the human body, endangering human health.

Marine oil pollution has a strong poisoning effect. It will consume dissolved oxygen in seawater, affecting photosynthesis, and ultimately lead to imbalance of marine ecosystems, triggering ocean red tides, destroying coastal wetland resources, and endangering marine fishery resources. According to the principle of "natural lag in the ecological process", the harm from controlling the oil spill to it is finally reduced, and there will be a lag process. Therefore, the harm to the public's health will be detected after a long period of time, and the hazard is difficult to control.

According to the "Bulletin" in the year of 2013-2017, the distribution of petroleum content in China's seas is shown in the following Table 10:

Table 10: 2013-2017 Distribution of petroleum content in China's seas (unit: square kilometers)

Years	The petroleum content exceeds the standard sea area of 1 and 2 seawater quality standards	Spring	Summer	Autumn	Winter	Main distribution
2013	17150					Dalian near shore, Liaodong Bay, Bohai Bay, Laizhou Bay, Pearl River Estuary, etc.
2014	42630	13090	18760	10780		Liaodong Bay, Laizhou Bay, Taizhou Bay, West Coast of Guangdong, West Bank of Leizhou Peninsula, etc.
2015	59480	9410	19560	15580	14930	Liaodong Bay, Coast of Guangdong, etc.
2016	24360	13520	10840			Leizhou Peninsula, etc.
2017	18910		10630	8280		Pearl River EstuaryNearshore area、Leizhou Peninsula, etc.

From the Table 10: 2013-2017 Distribution of petroleum content in China's seas (unit: square kilometers), we can see that with the progress of

transparency in China's government affairs, the data available to the public on marine pollution are becoming clearer and clearer. It can be seen from the main distribution areas that the oil content in China's seas has gradually shifted from the major harbors to the near shore and offshore areas, indicating that oil pollution in the sea has been effectively prevented. In view of the complete data on the distribution of petroleum content in China's seas in the summer of 2014-2017, and the summer is the peak season of oil pollution, we can see that the oil content in China's seas is greatly reduced, indicating China's oil pollution prevention and control policy. It has played a great role in the prevention and control of the actual application, effectively inhibiting the pollution of oil to the Chinese seas, and has played a very good governance effect on the polluted sea areas.

According to the 2017 Statistical Bulletin of Transportation Industry Development, in terms of transportation equipment, China has 146,900 water transport vessels at the end of 2017; the net load is 25,651,300 tons; the passenger capacity is 967,500 passengers; The container has a capacity of 2,163,300 TEU.(The statistical bulletin on the development of the transport industry, 2017)

Fig.6: National water transport ship ownership in 2013-2017

According to the statistical bulletin on the development of the transport industry in 2017, in terms of transport equipment, the composition of China's national water transport ships in 2017 is shown in Table 7(The statistical bulletin on the development of the transport industry, 2017): It can be seen that the container space has an obvious upward trend, while other aspects have decreased to varying degrees.

Table 11: The composition of China's national water transport ships in 2017

Index	Unit	Actual results	Growing over the previous year
Inland river transport vessel			
Number of shipping ships	Million	13.23	-10.1
Net load	Million	13149.73	-1.6
Carrying capacity	Million	72.3	-6.6
Container position	Million TEU	32.48	9.3
Coastal transport vessel			
Number of shipping ships		10318	-1.9
Net load	Million	7044.41	4.5
Carrying capacity	Million	22.36	9.9
Container position	Million TEU	50.17	19.7
Ocean shipping vessel			
Number of shipping ships		2306	-4.3
Net load	Million	5457.5	-16.3
Carrying capacity	Million	2.08	-13.7
Container position	Million TEU	133.66	11.9

Source: The statistical bulletin on the development of the transport industry in 2017

In terms of transport services, it handled 283 million passengers and 7.766 billion passenger km in the whole year. It completed 6.678 billion tons of cargo volume and 9861.125 billion tons of cargo turnover. Among them, the inland river transport completed the cargo volume 3.705 billion tons, the cargo turnover 1494.868 billion tons; Coastal transport carried 2.213 billion tons of freight and 2,857,871 million tons of goods. Ocean-going transport carried 760 million tons of cargo and 5,508.386 billion tons of cargo.

China's ports handled 185 million passengers. Among them, the number of coastal ports has reached 87 million. 98 million people were employed in inland ports. China's cruise passenger transport volume of 2.43 million people.

China's ports handled 14.07 billion tons of cargo. Among them, 9.057 billion tons were completed in coastal ports. Inland ports completed 4.95 billion tons.

It can be seen from Figure 6 and Table 7 that according to the 2017 Statistical Report on the Development of the Transportation Industry, it can be seen that the number of Chinese ships has been declining year by year from 2014 to 2017, which has a great relationship with China's strict control of the entry mechanism. The growth trend and range of container positions can reflect the standardization of transportation products and the set of a complete transportation system that has been established.

It shows that China has continuously strengthened the construction of water transportation in recent years, and has made great progress and has the significance of sustainable development.

V. Institutional Improvements for Marine Pollution Response

5.1 Improving Participants' Entry and Exit Mechanisms

5.1.1 Improving the Entry and Exit Mechanisms of Public Participation in China's marine environmental protection.

As analyzed in the previous section, the public as participants belongs to the nature of mixed participants in which both groups and individuals come together to serve for common purposes.

In this context, the first way to improve the entry and exit mechanisms of the public participating in China's marine environmental protection is to improve the entry and exit mechanisms of NGOs who focus on oil spill environmental protection. At present, China's relevant regulations on the entry and exit mechanism of non-governmental NGOs include the "Regulations on the Registration and Administration of Social Groups" (the latest revision as published in 2016) and the "Interim Regulations on the Registration and Administration of Private Non-Enterprise Units" which came into effect in 1998. These two regulations should be applied here to enhance the public's enthusiasm and commitment on marine environmental protection.

As illustration, social organizations refer to non-profit social organizations formed voluntarily by Chinese citizens to carry out activities in accordance with their statutes for fulfilling the common interest of their members. Meanwhile, private non-enterprise units refer to social organizations organized by enterprises, institutions or other social forces, as well as citizens and

individuals using non-state-owned assets to engage in non-profit social service activities.

According to the List of China Marine Environmental Protection Organizations, as many as 191 organizations were included in the field of marine environmental protection in 2016 : 34 domestic marine environmental protection social organizations, 18 domestic marine environmental protection student associations, 8 domestic marine related environmental protection foundations, 18 international marine environmental protection non-governmental organizations, 63 domestic marine related environmental protection social organizations, 16 domestic marine related environmental protection student associations, 4 domestic support social organizations and 30 other relevant organizations.

It should be pointed out that out of the aforementioned 191 organizations, 47 were found lack of background information : 12 domestic marine environmental protection student associations and 10 domestic marine environmental protection social organizations (List of China Marine Environment Protection Organizations, 2016). Refer to Table 12: China Marine Environmental Protection Organization (edition 2016):

Table 12: China Marine Environmental Protection Organization (edition 2016)

TYPE	NUMBER
Domestic marine related environmental protection social organizations	63
Domestic marine environmental protection social organizations	34
Domestic marine environmental protection student associations	18
International marine related environmental protection NGOs	18
Domestic marine related environmental protection student associations	16
Domestic marine related environmental protection foundations	8
Domestic support social organizations	4
Other relevant organizations	30

Looking into details, most of the activities of marine environmental protection organizations are scattered and spanning at a wide range. Most of the marine environmental protection organizations do not concentrate all their energies and efforts on a specific professional field for in-depth research and lasting exploration. The main reason underlying this situation is the resource constraints faced by most China's marine environmental protection organizations. In order to obtain resources for survival and development, we

need to adopt a multi-source strategy. Hence, the projects of the organizations tend to diversify following different requirements of the resource providers instead of concentrating on a specific professional field.(List of China Marine Environment Protection Organizations, 2016)

In China, the concept of social organizations is more in line with the international concept of NGO. When applying for the establishment of a social organization (entry mechanism), a sponsor shall apply to the registration authority for registration only after the examination and approval of the competent business unit. The same procedures applied for cancellation of registration (exit mechanism) as well where a sponsor could apply to the registration authority for cancellation of registration only after the examination and approval of the competent business unit. In short, the social group's role is totally supervised and managed by the government from the very beginning to the end of its establishment. On top of that, submission of work report on previous year' s sum up to the competent business units for annual inspection is also compulsory.

Therefore, the entry and exit mechanism of NGOs in China is quite dependent on the government. It is necessary for the government to supervise and manage NGOs. However, the government's control over NGOs' entry is not conducive for the active participation of non-governmental forces in China's marine environmental protection work. I suggest that the government's control over NGOs should mainly focus on the supervision after the establishment. Government should assist NGOs to promote environmental protection work, help them to establish a shaping system and grant them a certain amount of financial support.

The second way to improve the entry and exit mechanism of public participation in China's marine environmental protection is to improve the entry and exit mechanism of individual participation in oil spill environmental protection activities. Pathetically, public nowadays tend to participate in China's marine environmental protection passively as in they get involved in marine environmental protection only after realizing their own interests are threatened. Individuals do not give proactive commitment in monitoring the government's marine environmental protection affairs out of their sense of responsibility.

According to Article 4 of the Measures for Public Participation in Environmental Protection adopted by the Ministry of Environmental Protection in 2015, "The competent environmental protection authorities may organize symposiums, expert demonstrations and hearings to solicit the opinions and suggestions of citizens, legal persons and other organizations on matters or activities related to environmental protection by soliciting opinions and questionnaires." These measures could be taken as passive entry mechanism. On the other hand, "Citizens, legal persons and other organizations can make comments and suggestions to the competent environmental protection authorities by telephone, letter, fax, network, etc." suggests ways to the active entry mode. Apart from that, Article 11 too justifies "Citizens, legal persons and other organizations who find that any unit or individual has polluted the environment and destroyed the ecological environment may report to the competent environmental protection authorities by means of letters, faxes, e-mails, 12369 hotline and government websites." Not least to be mentioned, Article 12 says "Citizens, legal persons and other organizations

shall have the right to report to their superior organs or supervisory organs if they find that local people's governments at various levels or competent environmental protection authorities at or above the county level do not perform their duties in accordance with the law." These articles should be used to enhance public participation and be implemented in practice.

Because of China's large population base and the many environmental protection problems it faces every day, it is not realistic to reply to every public participation. However, marine environmental pollution accidents caused by oil spill are less likely to occur than other environmental protection problems and hence, every response should be attended at best they could.

For example, in the process of perfecting the entry mechanism of individual into marine environmental protection, special hot lines for reporting or other ways of lodging a complaint should be set up in coastal areas in order to "make head or tail" of individual reporting and complaint behavior. In another word, timely response should be given to individuals after the adjustment is clear. If the response rate could reach at least 80%, the individual's entry into marine environmental protection can then be ensured to be effective.

With respect to the withdrawal mechanism of individual participation in marine environmental protection, the fundamental thing to do is to keep the relevant information of the whistle-blower confidential while protecting his legitimate rights and interests. This is of utmost importance to ensure the withdrawal integrity of an individual from the current marine environmental protection act. In order to prevent disclosure of the relevant information of the whistle-blower, Article 49 of the Criminal Procedure Law and article 308

of the Criminal Law have made principled provisions for the strict protection of whistle-blowers and witnesses' interests. Apart from that, the Supreme People's Procuratorate, the Ministry of Public Security and the Ministry of Finance had jointly issued the "Several Provisions on Protecting and Rewarding Reporters of Duty Crimes", further clarifying and perfecting eight strict protection measures for whistle-blowers.

However, there are still many gaps and flaws in the mechanism left to be improved which led to further deterrence and lax implementation of the whistle-blower information system. To nip this in bud, we need to establish a strict whistle-blower information protection institution within the marine environmental response institution. Indeed, whistle-blower's information leaks are so ubiquitous nowadays which makes it nearly impossible for the informers to retreat from the mechanism. Therefore, we should intensify the efforts to rectify them and brainstorm more ways to include in the marine environmental protection law of how to safeguard informers' information rights from leaking so as to improve the exit mechanism of individual participation.

5.1.2 Improving the Entry and Exit Mechanisms of Government Participation in China's Marine Environmental Protection

When discussing the government's boundary rules based on IAD framework, it is necessary to set the action perspective within the government. Each of

the relevant departments within a government should be regarded as independent participants and the entry as well as exit mechanism of respective departments should then be improved accordingly in dealing with oil spills on the sea.

Firstly, we should look into the marine environmental protection departments which involved in oil spill accidents and the entry mechanism of these departments. Particularly, marine environmental protection departments involved are The State Council or the Department of Transportation authorized by State Council, the State Maritime Administration, the marine administration directly subordinates to where marine incidents occur (generally directly under the Maritime Administration), the maritime administration at the place where the accidents occur (generally the local Maritime Administration), the fishery authority and the military authority, etc.

The Regulations of the People's Republic of China on the Investigation and Treatment of Marine Pollution Accidents (hereinafter referred to as the "Regulations") clearly stipulate that after receiving the report of marine pollution accidents, the maritime administrative agencies shall conduct timely verification as well as evidence collection and conduct on-site investigations. The investigation of ship pollution accidents shall be carried out by at least two investigators who in-charge for ship pollution accidents. The vessel pollution accident investigation and treatment organizations shall determine the extent of accident pollution and which departments involved shall be informed to participate in the investigation.

It can be seen that China's legal construction on oil spill from ships is more comprehensive than pollution caused by other reasons. It is suggested that the government should establish a regulatory model with comprehensive coverage, assisted by multi-regional and multi-sectoral shared governance

model. Specifically, departments should establish information, material and technology sharing mechanism in different regions, train more professional ship pollution accident investigators, form the ability to cooperate and cope with each other in the event of incidents and seriously deal with the act of shifting responsibilities. With such efforts, the entry mechanism and accessing ways to government departments could be improved and clarified.

5.1.3 Improving the Entry and Exit Mechanisms of Polluters Participation in China's Marine Environmental Protection

As one of the participants, the only mechanism for the polluters to enter the arena of China's marine environmental protection is that they may or have already polluted the marine environment of China. In the background of this study, the enter mechanism of polluters is the oil spill accident may or has happened. After eliminating the consequences of marine environmental pollution, polluters can exit from the arena of marine environmental protection.

The entry mechanism of polluters' participation in China's marine environmental protection should be linked to the government's supervision. In another word, the contributing polluters should be able to be accurately arrested every time an oil spill accident happened. This is ensure that the polluters will not escape from the arena of action and as a consequence, improve the entry mechanism of polluters.

On the other hand, the exit mechanism of the polluter's participation in

China's marine environmental protection should be linked to the government's actions. That is, after each oil spill incidents, the polluters should make compensation actions according to the compensation mechanism and exit from the arena of action once the compensation action is completed.

Therefore, it is necessary for China to establish a complete ecological compensation mechanism, improve compensation projects especially pertaining to oil spill accidents and develop sustainable compensation policy. A note to be made, neither compensation projects nor policy should emphasis only on determining temporary pollution damage because marine pollution caused by oil spill leaves prolonged defect.

In addition, it is necessary to determine whether the polluter has the right to enter the entry mechanism for second time after exiting from the last pollution behavior of the oil spill accident. Such judgement should be taken into account by the marine environment response institutions. For repetitive violators, the entry mechanism should be closed down.

That is to say, whether the pollution accidents caused by the polluter can deprive the polluter of the relevant maritime operations is very important. If the polluter considers that his profit is greater than the compensation for the ship pollution accident, he will continue to pollute the marine environment recklessly.

5.2 Encouraging Participants' Behavior by Various Methods

5.2.1 Encouraging Participants' Behavior

Stimulate public behavior through payment rules. Relevant administrative units of China's marine environmental protection shall formulate reward rules for the protection of China's marine environment from oil spill pollution and damage, and publicize them to the media to encourage and guide citizens, legal persons, NGOs or other organizations to provide specific information they know about oil spill acts or activities harmful to marine environmental protection to relevant administrative units. Or actively participate in the cause of marine environmental protection, thereby triggering the administrative action of administrative units, and ultimately achieve the goal of effective prevention and control of China's marine environment.

The reward rules should avoid the traditional single spiritual reward, and should fully increase the proportion of economic reward. Firstly, the government should provide bounty for reporting. The Securities and Exchange Commission (SEC) amended and added the Securities Act in 2010. According to the SEC's reporting reward system, the law enforcement cases with fines exceeding $1 million will be awarded bonuses to whistle blowers according to 10% to 30% of the amount of fines. It is suggested that China should improve the relevant regulations on reporting in environmental protection law, and that a certain proportion of the amount of administrative penalties should be used for issuing reporting rewards, just like the reporting reward system of the Securities and Exchange Commission of the United States.

Second, the government should provide bounty for outstanding performance. In view of the outstanding public participants in dealing with oil spill accidents, we should publicize them in the media as models and models, play a positive and positive role in influencing the marine environmental protection culture, establish a good external environment, and stimulate more public participation in China's marine environmental protection actions. In particular, NGOs, which have made outstanding contributions to marine environmental protection, generally face the problem of lack of funds. The reward can not only alleviate the pressure of funds, but also play a side role in supporting the development of NGOs.

Stimulate government behavior through payment rules.

Put the perspective into the various administrative departments related to marine environmental protection within the government, and stimulate the positive behavior of all relevant departments, even independent civil servants, through payment rules. First, rationally design the salary system to avoid the "adverse selection" of civil servants. This problem has been analyzed in 5.1 of this study. China's civil servant salary system has failed to a certain extent. Grass-roots civil servants account for a large proportion, but enjoy a lower salary. However, grass-roots civil servants are in close contact with the public as a close stratum. Lower salaries tend to lead grass-roots civil servants to concentrate on upgrading, while ignoring the nature of the work, but also cause grass-roots civil servants to concentrate on interests in the interests and standards, thus resulting in "adverse selection". Therefore, the rationalization of the civil servant salary system can avoid the loss of elite civil servants, improve the reasonable promotion system can prevent the bad

situation of “bad money expelling good money“, introduce a scientific performance appraisal system, make the civil servant appraisal more modern, formulate a reward system, and stimulate the motivation of civil servant work.

Second, we should strengthen the punishment system to avoid civil servants taking “moral hazard“. In the framework of IAD, the payment rules correspond to the cost and benefit elements. By strengthening the punishment system, that is, increasing the cost of making mistakes, the acts of making mistakes will be reduced accordingly. They will be put on the stage of action of China’s marine environmental protection, that is, increasing the penalties for the negligence of government agencies related to marine environmental protection, and increasing the penalties for the negligence of personnel within government agencies related to marine environmental protection. It will effectively improve the effectiveness of marine environmental protection behavior, and avoid the indirect pollution of marine environment caused by the acceptance of bribes by polluters or neglect of effective information from the public by relevant units of marine environmental protection.

5.2.2 Constructing the Bridge of Participants’ Participatory Behavior

Information rules affect the level of information available in action situations and the links between action and outcome. That is to say, in China’s marine environmental protection and prevention system, information rules on the impact of oil spill on the marine environment affect the

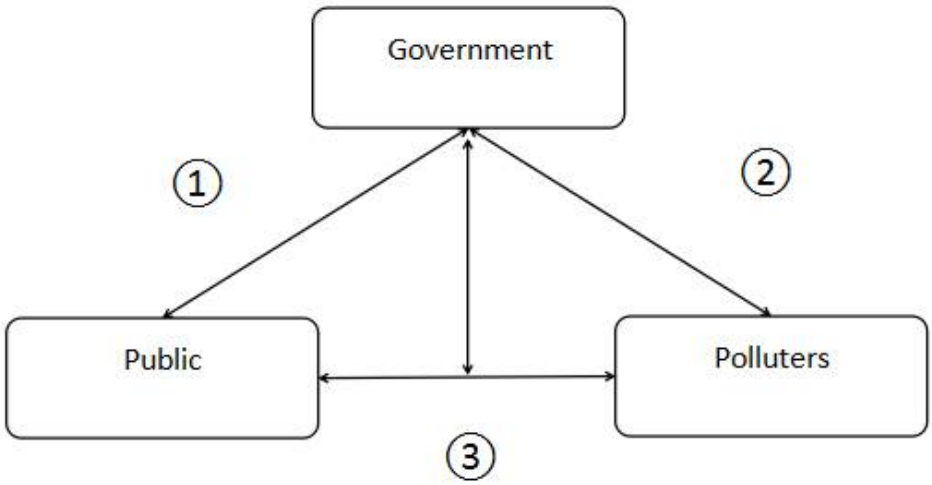
available information level in marine environmental protection and prevention, as well as the relationship between marine environmental protection behavior and the effective improvement of marine environmental pollution caused by oil spill. Four important points in information rules are to establish good channels of information flow, to adjust the frequency and accuracy of appropriate communication, to use official languages and to determine the topic of communication.

Establish a well channel of information flow. Based on the IAD framework, China's marine environment prevention and control system caused by oil spill is constructed. Participants include the public, the government and the polluters. The stage of action is China's marine environment prevention and control. According to the definition of information rules, channels can be expressed as a fully connected polygon. Three types of participants should have three information channels. (See Figure 7: The channels of information flow in China marine environment response) These three channels of information flow acquire information in sequence.

The polluter is the first to know the information of oil spill accident. After the oil spill accident happens, the information is transmitted to the relevant government departments through channel two. After the government understands the situation of oil spill, it arrives at the scene or issues instructions to take the second part of information to prevent and control oil spill pollution. Site information is released to the public through channels and directives are sent back to the polluters through channels. Channel 3 accounts for a small proportion in China's marine environment prevention and control system. It generally occurs in the coordination of compensation between the

harmed groups and polluters among the public, but most of them are interfered by the government.

Fig. 7: The channels of information flow in China's marine environment response



Strengthen the first channel between the government and the public – strengthen information disclosure. According to Article 17 of the Marine Environment Protection Law of China, "Units and individuals that cause or may cause marine environmental pollution accidents as a result of accidents or other unexpected events must immediately take effective measures to

inform potential victims in a timely manner, and report to the departments exercising the power of supervision and management of the marine environment in accordance with the provisions of this Law, and accept investigation and treatment.“ It can be seen that according to the law, there is a channel for the government to disclose information to the public, but the information is incomplete, and the public receiving information is incomplete. It is necessary to increase the first time to use the media as the media to disclose the specific information of the oil spill accident to all the public.

Strengthen the second channel between government and polluters – improve accident information. According to Chapter 2 of the Regulations of the People's Republic of China on the Investigation and Treatment of Marine Pollution Accidents, Accident Report emphasizes the comprehensive information disclosure criteria for polluters to the government after pollution accidents occur. For example, Kangfei and CNOOC did fulfil their environmental information reporting obligations after the oil spill accident occurred in Bolai 19-3 oil field.

However, it is impossible to confirm whether there are false reports, omissions or even hidden accidents that can not be found due to technical problems.

Therefore, the improvement of the second channel is supported by the government expeditiously by experts. The government gives training courses on important information before the occurrence of the polluter's maritime affairs to the crew on board so that after the accident, the crew can clearly report the information and ensure that after the improvement of the statistical information, the government transmits the information to the public

through the first channel in order to avoid causing social conjecture or panic.

Secondly, adjust the appropriate communication frequency and accuracy. The frequency and accuracy of the second channel should be the strongest, because the oil spill accident at sea is an unexpected event, there is no fixed discharge time and mode, generally accompanied by great contingency and destructiveness, the polluter is in the accident center, and the latest pollution situation should be communicated with the government in time, and the information requirements are accurate and fast.

In view of the wide influence of the first channel, the government should inform the affected people in time after determining the pollution scope, inform the public widely after determining the pollution data and solutions, and ensure the accuracy so as not to destroy the government's prestige. The communication frequency of the third channel is the lowest of the three. Generally, the communication between the public and the polluters is involved in the communication of compensation or supervision, and most of them involve the government. Therefore, the guarantee of the communication frequency of the third channel requires the government to entrust NGOs to carry out daily supervision and follow-up after the accident.

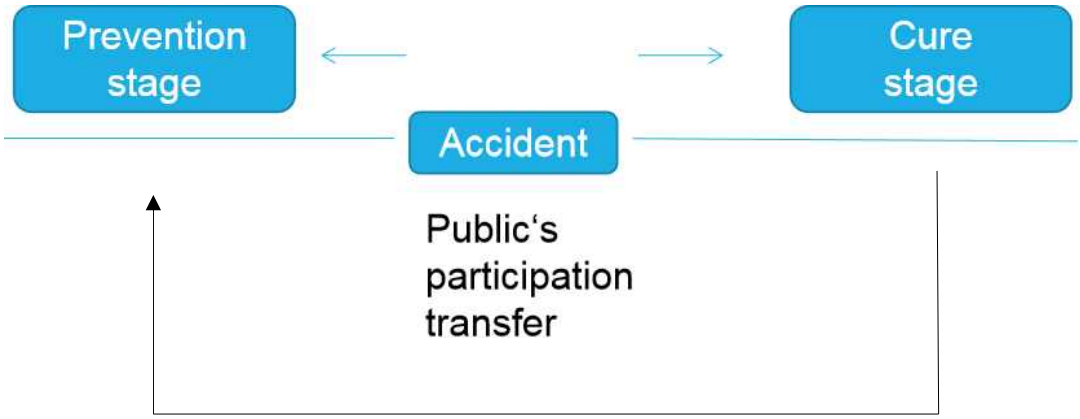
Third, the use of official languages and the identification of communication themes. When communicating information through the second channel, it is necessary to upload the "Report on Marine Pollution Accidents" in strict accordance with the Regulations. The relevant contents of the "Report on Marine Pollution Accidents" should be shared in time by relevant units within the government to ensure the smooth transmission of information.

5.2.3 Motivating Participants' Behavior

This study suggested that the public should be allowed to participate in the response institution of marine environment in China. At present, in China's marine environmental response institution, public participation is mainly concentrated after the accident, and is not fully involved in the prevention stage. Marine environment response institution work is a multi-dimensional and multi-subject systematic project. The government alone is not enough to accomplish this complex task. The improvement of marine environment prevention and control performance can not be separated from the extensive participation of the public. The construction of "cooperative prevention and control mode" of government, enterprises, society and the public is the inevitable requirement of future marine environment prevention and control work.

Therefore, this study proposes to enhance the participation of the public in the pre-planning stage, strengthen the "active participation" and bid farewell to "passive participation" in the Chinese marine environmental response institution.(see Figure 8)

Fig. 8: The government should lead a shift in the focus of public participation



The report of the Nineteenth National Congress of China pointed out that in order to "treat the ecological environment as life, implement the strictest ecological environment protection system, and construct an environmental governance system with the government as the leading body, enterprises as the main body, social organizations and the public as the participation", in order to achieve this goal, it is necessary to set aside participation positions for social organizations and the public through the rules of location. To improve the marine environment prevention and control system, we need not only to enhance the effectiveness of the public participation process, but also to ensure the effectiveness of the results of public participation.

Specific practical measures can be through the publicity hotline, supervision hotline, letters and mailboxes, network answering questions and so on.

On the other hand, the government can foster environmental NGOs and expand NGOs' participation in marine environmental prevention. For example, training courses for polluters, regular assessment of crew knowledge, ensuring that all involved in oil spill activities are fully aware of the safety rules and avoid oil spill accidents, NGOs regularly carry out workshop publicity activities to let the public understand the harmfulness of oil spill and arouse the desire to participate in the protection of the marine environment.

In general, at the national level, holding oil spill hearings ensures the participation rate of the public, but the concept of the public is not the party-free people in the government, but the ordinary people who are keen on environmental protection. Ensuring that NGOs cooperate with the government to prevent oil spills and increase the participation rate of NGOs can also ensure the survival status of NGOs.

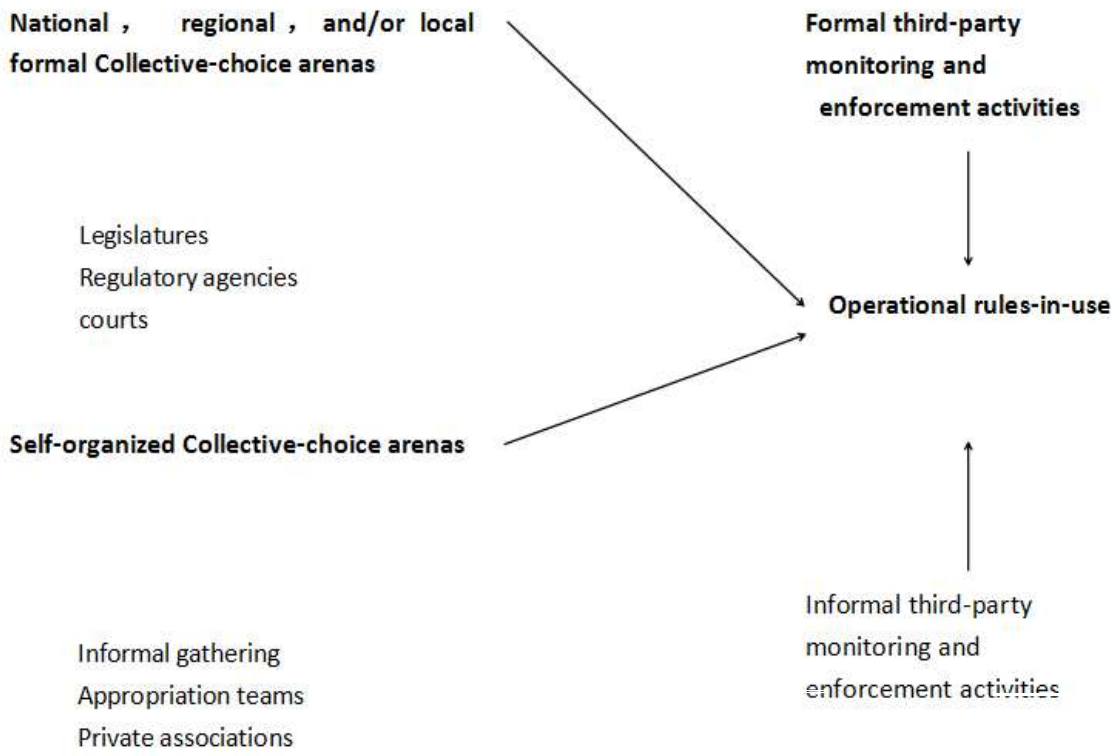
Although the operation method of appeal is embodied in the "Measures for Public Participation in Environmental Protection", the frequency of appeal is not clearly defined in the "Measures". This study suggested that there should be more than four expert demonstration meetings and symposiums per year. When there are corresponding emergencies, the time of the symposium can be adjusted, the opinions of the masses can be actively listened to, and the problems of the masses can be feedback in time to ensure the effectiveness of public participation.

5.3 Improving the Legal System Construction Related to Oil Spill

5.3.1 Improving the Construction of Oil Spill-related Legal System through Choice Rules

Ostrom mentions collective choice rules and constitutional choice rules in her book on institutional diversity. Collective choice rules influence business activities and outcomes by influencing the impact of determining who is eligible to be a participant and the specific rules used to change operational rules. Constitutional selection rules influence collective selection activities by first determining who is eligible to be a participant and by establishing rules for collective selection rule sets, which in turn affects a series of operational rules (Brennan and Buchanan, 1985). The relationship between formal and informal Collective-choice arenas is shown in Figure 10. This chapter refers to the improvement of oil spill-related legal system construction through choice rules. It refers to the influence of choice rules on the construction of oil spill legal system in the formal collective choice fields of the country, region and local.

Fig. 9: Relationships of formal and informal collective-choice arenas



Source : Ostrom, 1996, Understanding institutional diversity, p62

Choice rules affect the allocation of specific action sets to positions. The above analysis shows that choice rules specify what participants who occupy a position must, must or can do at a particular point in the decision-making process based on conditions that have been or have not been met at that point. The actions that participants must, must, cannot or can take depend on their positions, previous actions taken by others and/or themselves, and the attributes of the relevant state variables.

When it comes to the construction of oil spill-related legal system, the perspective of the action stage should be placed within the government, as shown in figure 6, and within the legislature.

Construct a para-militarized unified maritime law enforcement team. At present, China's maritime law enforcement departments mainly include the frontier security seascape forces, the China Maritime Supervisory Corps under the State Oceanic Administration, the Maritime Bureau of the Ministry of Communications, the Fisheries Bureau of the Ministry of Agriculture and the Anti-smuggling Bureau of the General Administration of Customs. According to the statistics of 2007, the number of maritime law enforcement teams in the five departments is nearly 100,000, equipped with more than 3000 ship inspections.

Comparing with the situation in the United States, the United States Coast Guard is currently staffed by about 4200 people and equipped with more than 1600 ship inspections. So in terms of quantity, China has a unified maritime law enforcement team, so as not to improve the current situation of maritime fishing boats, law enforcement fleets, maritime frontier defense, customs, port supervision, fishery administration and other labor enforcement, although this division of labor and law enforcement seems clear. However, in the face of the sudden oil spill from ships and the level of cooperation of various departments, the establishment of oil spill emergency center has obviously improved the overlapping jurisdiction of many departments, resulting in conflicts. Therefore, the establishment of unified law enforcement team will also relieve the conflict of jurisdiction of law enforcement departments, and can protect the marine environment and marine ecological resources more

effectively.

5.3.2 Improving the Construction of Oil Spill-related Legal System through Scope Rules

According to the "Environmental Protection Law" and the "Plan", when oil spill occurs, the local maritime authorities and the higher maritime authorities shall carry out unified and coordinated management. Major oil spill accidents shall also be managed by the maritime authorities designated by the State Council. Therefore, under the accelerated development of market economy, this situation of "multiple management" is facing many challenges. The emergence of local protectionism and other issues constantly challenges the status of "multiple management". At this time, the scope rules are increasingly influencing the construction of oil spill-related legal system.

Considering the interests of the whole society, the central government divides oil spill prevention and control into administrative areas, and refines the obligations of marine environmental protection. However, the development of local governments is mostly linked to economic interests. When environmental protection and prevention measures conflict with local economy, they are often compromised. When the economic interests of the oil spill-related units are closely related to the local economic interests, the local government will also give preferential policies to the units concerned.

In the long run, "multiple management" does not take into account the details, the system is complex, and the speed of processing information is

more likely to nourish "local protectionism".

For polluters, the potential consequences of pollution of the marine environment do not affect their net income, or the effect of net income is not significant, then the current marine prevention and control system will not play a role in restricting polluters.

Therefore, according to the scope rule, This study suggests that we should improve the scope rule of legal liability, link the relevant legal liability with the local maritime authorities according to the scope rule, and cooperate with the selection rule to construct the vertical management mode of the government.

That is, through the vertical direct control of oil spill-related affairs, the central government can get rid of the protection and intervention of local governments, reduce the scope of local government's participation to cooperate with the work, maintain the unity of legal system and order, strengthen the unity of marine law enforcement, while the vertical management mode is easy to breed corruption, which is supervised by local governments in conjunction with the local marine environment. This part will be elaborated in 5.4.

5.4 Improving Supervision

Aggregation rules affect the level of control that individual participants perform in situations or in cross-context connections. That is to say, in the marine environment prevention and control system caused by oil spill, the aggregation rules affect the level of control of the public, the government,

and the polluters in performing marine environmental protection behaviors, that is, the magnitude of control.

The role of aggregation rules in the government is most obvious, put the perspective inside the government, in order to build a more convenient marine environment response system, this study suggests that a unified vertical management mechanism should be established inside the government, and that the local maritime departments should be in the position of supervision and auxiliary work. According to the aggregation rules, that is, the aggregation rules affect the control level and control power of the local maritime departments in the marine environment prevention scenarios or in the cross-regional marine environment response requests.

That is to say, by means of aggregation rules, the original control power of local maritime departments in oil spill accidents will be reduced, and they will no longer have the role of guiding management and strengthening the supervision power. Breaking the original scope rules and no longer setting up environmental protection departments in accordance with administrative regions, but setting up environmental protection departments in accordance with the scope of marine environment, and increasing the power of vertical management institutions through aggregation rules, this vertical management mode can effectively strengthen the supervision and management of national environmental protection work, and is conducive to the overall arrangement of environmental protection prevention and control work at the national level. It is more conducive to the effective allocation of resources.

Focusing on China's marine environmental protection institution, the aggregation rules also affect the control power and control level of the public and polluters, strengthen the public's participation, and put the position of

public participation in key positions is to strengthen supervision through aggregation rules. This part requires the cooperation of position rules and aggregation rules, as explained in the previous section.

This point can also be discussed from the perspective of game theory. It is necessary to make good use of the aggregation rules to influence the control of the public and polluters. In the pre-stage prevention stage of the marine protection and prevention mechanism, it is necessary to increase the cost of polluters by adding preventive measures and equipment.

Assume that the cost of adding preventive measures is b, and the public expands its control authority because of the aggregation rules, so that the increased supervision cost is a;

The government's penalty for pollution caused by polluters due to lack of timely preventive measures is c;

However, the amount of punishment c is probabilistic, that is to say, the contaminant does not consolidate the preventive measures may bring adverse consequences, and may also be lucky not to cause an oil spill, so there is no need to pay the penalty amount c;

The probability of contamination of an oil spill accident is p = (0, 1), that is to say, only two cases of pollution accidents occur or not occur.

According to the above analysis, combined with game theory, the following Table 13. can be seen:

Table 13 : Game theory of add public supervision for polluters to enhance preventive measures

		Polluters --preventive measures	
		Add	Add none
Public supervision	Add	(a, b+a)	(a, p*c+a)
	Add none	(0, b)	(0, p*c)

According to the above table, from the perspective of game theory, each participant is a rational, self-interested participant.

Then, in the case that the public supervision does not increase, because p = (0, 1), the polluters will not increase the preventive measures in order not to increase their own costs. In this case, the polluter can only pay a penalty of 0 or c. It is the optimal strategy for polluters not to increase preventive measures.

Then, through the aggregation rules, the level of public supervision will be expanded. In the case of increased public supervision, the cost of supervision will increase, and the cost of supervision will be burdened on polluters.

Whether the polluters increase the preventive measures must pay the fixed

cost a, that is, the cost of expenses for public supervision, and because of the existence of public supervision, the probability of p=1 is greater than p=0, then just ensure that p*c is much larger than b , it is possible to achieve a strategy for polluters to choose to increase preventive measures, and to form an optimal strategy for improving the marine environmental response institutions.

However, the formation of this optimal strategy is achieved by adjusting the control of the participants through the aggregation rules, which confirms the necessity of improving the regulatory means through the aggregation rules.

VI. Conclusion

With the gradual establishment and improvement of the oil spill response system, it can be seen that China is gradually paying attention to the response of marine environmental protection caused by oil spills. The problems related to response work have been gaining attention from all folks in the society as well. The public is of great importance to the issue of marine environmental pollution caused by oil spills, and experts as well as scholars have become increasingly aggressive in accelerating the establishment of China's environmental protection system.

Based on the IAD framework proposed by Ostrom, this study integrates the scene of the marine response institutions triggered by Chinese ship oil spills, and builds an IAD framework for the response institution of marine pollution caused by oil spills in China. This study starts by analyzing the current existing laws and regulations in China, as well as the interpretation of the marine response institutions by many experts. Then the shortcomings of the current marine protection and prevention system triggered by oil spills in China was analyzed. Consequently, this study found that 8 laws and regulations should be used in constructing a complete IAD framework for China's marine environmental protection system. In order to promote the institution of China's marine environment response, four possible improvements on the existing marine pollution prevention and control system triggered by oil spills were proposed.

First, improve the entry and exit mechanisms of participants in the boundary rules. That is to improve the entry and exit mechanisms of the public, government and polluters in the action arena of China's marine

response institutions. Improving the entry and exit mechanisms of participants can effectively mobilize the enthusiasm of participants.

Second, mobilize participants' enthusiasm in a variety of ways. It is recommended to stimulate participants' behavior through payoff rules and build a bridge of participants' participation behavior through information rules. Specific operating methods suggested are providing bounty of reporting and for outstanding performance, increasing the punishment of polluters and other payoff rules to fully mobilize all sectors of society to pay attention to the marine environmental pollution caused by oil spill.

It is also recommended to improve the information rules by establishing three channels of information flow. To illustrate, we should make effort to balance the problems of information asymmetry among participants, make the ocean government open and transparent as well as help the third party to supervise and manage their organization.

Third, improve the legal system related to oil spills. Regulate the internal control structure of the government by defining scope rules and choice rules. This study recommended to establish vertical oil spill management, clarify the scope of rights, manage oil spills according to the laws, develop local economy according to the laws, avoid conflicts between local administrative objectives, and improve the indecisive and sloppy problems caused by the division of different department levels to deal with oil spills pollution.

Fourth, improve the regulatory links through aggregation rules. Through the aggregation rules, the original control power of local maritime departments in oil spill accidents will be reduced and they will no longer have the role of guidance and management. However, their powers of supervision will be increased. This is more conducive to the overall arrangement of environmental protection prevention and a better control at the national level. Not least to

be mentioned, such changes could also facilitate more effective allocation of resources.

In conclusion, this study aims to improve the response institutions of marine pollution caused by oil spill. Fully mobilizing the participation enthusiasm and effectiveness of participants in the action arena of marine pollution response action institutions as well as fully mobilizing all forces of society to participate in the major business of marine environmental protection in China are fundamental. Besides, improving the establishment of legal system related to oil spills from ships in China could definitely accomplishes the mission that marine pollution has laws for us to be abide by and all players have to strictly follow the rules. Establishing a vertical oil spill accident management model is also another vital call, so that marine pollution related government departments can play a common role and cooperate with each other.

However, there are two shortcomings in this study. Firstly, the data collection on the number of oil spill accidents and the amount of oil is not comprehensive enough. It can only be based on speculation to construct the trend of oil spill accidents under the control of rules.

Secondly, the data used in this study for introducing the degree of the damage in recent years is a bit outdated. Future study should continue searching for the new updates as the development of transparency proceeds in Chinese government affairs.

With the continuous improvement of data in the future, the sustainable development of existing marine environmental response institution will become more and more apparent. Meanwhile, there will always be in this study institutional problems. Future research should study the relatively weak compensation institution of China's marine response institution. On top of that,

following the institutional changes, continuous effort should be done to discover the emerging new problems of the marine environmental response institution and then propose relevant improvements from time to time.

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