

Analysis of Administrative Management and Operation Cost in China's Maritime Shipping Market

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ABSTRACT

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Seaborne trade is the most significant transportation mode in the International Trade Market. Transportation efficiency on the International Water is mainly influenced by the ship's performance and weather situation, while the efficiency of cargo transshipment and domestic transportation is significantly affected by the policies, regulations and management efficiency of the local government, which highly affects the change of the operating cost of enterprises. It is necessary for the government to optimize the Business Environment of Maritime Shipping Market (MSM) to improve Administrative efficiency and reduce the enterprises' operating cost. This study focuses on the status of China's government administrative management and the effect of the government's function to enterprises cost in maritime shipping market to provide the reference to optimize the Business Environment of MSM in China.

ADDITIONAL INDEX WORDS: *Shipping market, administrative function, government, management.*

INTRODUCTION

In recent years, China's maritime market has made a huge process with the gradually optimizing business environment. In 2018, the 19th CPC National Congress proposed the strategy of constructing High Quality Transportation Country, promoting the transformation of China from Huge Transportation Country to High Quality Transportation Country (Xi, 2017), and combining with the current situation of China, in order to accelerate the healthy development of MSM, further expand China's influence in global MSM, and form a market virtuous cycle, it is necessary to further reduce the operating enterprises' cost (Zhang *et al.*, 2019), stimulate their subjective operation willingness, and enhance their vitality (Jansson and Shneerson, 1986). Based on ensuring market safety, market vitality can be further inspired and high-quality market development would come true by improving regulatory efficiency, reducing administrative constraints and further opening the market control by Administrative Department (AD). Therefore, it is an important issue to be researched in China's MSM on how to improve the efficiency of Marine supervision to promote the development of Marine market, and this article will analyze the role of government and the operators in MSM and the corresponding responsibilities, and state the influencing factors of government department in MSM, and by analyzing and verifying the affecting factors' weight, the development direction will be ensured to finish China's administrative efficiency optimization reformation and strengthen the opening market construction.

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Background

Hong proposed that the safety, stability and efficiency in transportation are the most significant characteristics in the transportation design process, and infrastructure construction is an important part of the whole transportation chain, which the situation will directly affect the operating efficiency, cost and time (Hong *et al.*, 2016). Zhang proposed that intelligent transportation system (ITS) has been increasingly widely used in the construction process of comprehensive transportation system, and by using this system to obtain relevant data, vehicle emissions condition can be effectively mastered, which lead to the establishment of emission inventory, which made an improvement of the efficiency of transportation supervision (Zhang *et al.*, 2018). Feng Yun demonstrated electronic commerce based on Internet technology that it was gradually changing the goods circulation and organization in port area, which showed obvious competitive advantage in the customs declaration, inspection declaration, settlement, pay tax (back), virtual currency service *etc.*, and it could be predicted as a significant aspect in the future to reduce the energy consumption and improve efficiency to optimization the wisdom port service (Feng, 2017). Zhang (2014) suggested that in order to provide better port services, AD should be responsible for playing the guiding force of policy planning, the binding force of regulations and standards, and the driving force of market competition (Zhang, 2014). Liu *et al.* (2018) stated that the key driving factor to improve hub operation efficiency and service quality is to build hub evaluation and control, with further standardized management and control framework should be formulated in the regulatory process (Liu *et al.*, 2018). Trump Benjamin proposed that government administration should be under the regulation and status which asked the timeliness

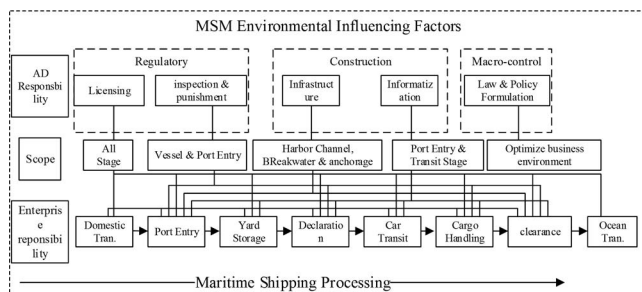


Figure 1. MSM environmental analysis model.

and maneuverability of policies formulation, revision and abolishment (Hasan *et al*, 2016).

Through the analysis of scholars' research results, at first, the current research content of AD and government supervision of China's MSM is limited and mostly lack of a macro perspective on China's MSM administrative management. Secondly, the discussion on the supervision of the AD concentrated mainly on the perspective of the specified tasks of AD to perform its responsibilities, but little research in the quantitative methods and lack of the refinement and differentiation of government different services.

METHODS

In this study, the author will fill in the research blank by establishing the MSM Environmental Analysis Model to analyze the current China's market situation; calculate the weight of government supervision index with entropy weight method; further verify the authenticity of the weight calculation results by using System Dynamics theory; on this basis, the MSM Regulatory Process Model will be established to clarify the relationship between enterprise management cost and AD administrative management, and by combing the current problem of China's MSM, the process optimization model will be built to put forward specific direction and task of shipping market regulation reformation in the country to provide a reference for the relevant AD of the optimization of the shipping market administrative services.

Government Management Process Analysis

According to P.R.C. International Ocean Shipping Act (2013), P.R.C. Port Law. (2018), P.R.C. Maritime Transportation Safety Law, (2016) and other relevant laws and regulations, and accord with the current situation of MSM in the country, the model was built by integrating the related functions in all AD in the MSM (Figure 1), and the shipping market of the country was carried on the preliminary analysis (Lun *et al*, 2010).

Firstly, according to the model, China's international shipping process was divided into eight stages, which can be logically divided into Domestic Transportation, Port Entry, Yard Storage, Declaration, Car Transit, Cargo Handling, Clearance and Ocean Transportation. Secondly, the three main AD functions were divided into five parts, among which

the Regulatory Function was divided into Administrative Licensing and Administrative Inspection and Punishment, the Construction Function was divided into Infrastructure Construction and Informatization, and the Macro-control Function is specified into the law & policies formulation & punishment. Thirdly, it clarified the specific stages and contents of the enterprise operation involved in the governmental supervision function. Through the construction of MSM Environmental Analysis Model, the main participants and related functions of the market were further defined, and the relationship between the participants' supervision and supervision was carefully sorted out.

Government Management Driving Factors Weight

On basis of determining the influencing factors of government management of MSM, the weight of AD services was calculated to determine the influence of different service forms on the overall service of cargo transit. In order to avoid the one-sidedness of subjective weighting method or objective weighting method, the author will use integrated weighting method to calculate the weight of service form (Qi, Zhu, and Duan, 2016).

At first, subjective weighting would be adopted below. Based on the above discussion results in Figure 1, the service form weight of AD was used to calculate in Delphi method. By summarizing the evaluation results of the experts, the following results are obtained:

Then the objective weighting method was applied below. The author used Entropy method to calculate the index weight. The author designed expert questionnaires and investigated the scores, which the standard was divided into four levels: Major Impact (1), Larger Impact (0.7), Small Impact (0.4) and Mild Impact (0.1), according with the main international transportation port in China, including Shanghai Port, Ningbo Port, Zhoushan Port, Shenzhen Port, Guangzhou Port and other 10 transshipment port and maritime transportation lanes and government management situation. The author built the entropy value method of judgment matrix, calculated entropy of five evaluation index, and obtained evaluation index of entropy for (m = 10, n = 5):

$$E_j = -(\sum_{i=1}^n a_{ij})/ln(m), i = 1, 2, \dots, m; j = 1, 2, \dots, n \quad (1)$$

On basis of gaining the entropy value, the entropy weight is calculated as follows:

$$W_j = \frac{1 - E_j}{n - \sum_{j=1}^n E_j}, j = 1, 2, \dots, n \quad (2)$$

Five entropy weight indexes, namely, Administrative Licensing, Administrative Inspection and Punishment, Infrastructure Construction, Informatization Construction, and Law & Policies Formulation & Punishment, respectively, were obtained: 0.19, 0.24, 0.19, 0.25, 0.12.

As a result, subjective weights were obtained $W_j^1 = (0.23, 0.17, 0.14, 0.36, 0.1)$, objective weights were obtained $W_j^2 = (0.19, 0.24, 0.19, 0.25, 0.12)$. Combination with Integrated Empowerment method, in order to determine the weight

coefficient of W_j^1 and W_j^2 a_1 and a_2 , the weighted least squares optimization model was built as follows:

$$\min Z(W) = \sum_{i=1}^n \sum_{j=1}^m p_1 [(W_j - W_j^1) b_{ij}]^2 + \sum_{i=1}^n \sum_{j=1}^m p_2 [(W_j - W_j^2) b_{ij}]^2 \quad (3)$$

Taking the derivative of the above formula, the optimal solution of the model could be obtained accord with the necessary conditions for the existence of extreme values:

$$W_j = p_1 W_j^1 + p_2 W_j^2 \quad (4)$$

By using the definition of Relative Entropy, when the weight vectors given by the two weight calculation methods could be regarded as discrete distribution, Relative Entropy could be used as a measurement of the degree of coincidence between the two methods. The form of Relative Entropy of two weight vectors p_1 and p_2 were defined:

$$z(v_1, v_2) = \sum_{i=1}^m v_{1i} \log \frac{v_{1i}}{v_{2i}}, h(v_1, v_2) = 0, \forall i \in M, \exists v_{1i} = v_{2i} \quad (5)$$

According to the above principles, the problem can be converted into:

$$\min Z(d) = \sum_{i=1}^m h_i \log \frac{h_i}{v_{1i}} + \sum_{i=1}^m h_i \log \frac{h_i}{v_{2i}}, s.t. \sum_{i=1}^m h_i = 1, h_i > 0 (i \in M) \quad (6)$$

For the optimal solution h^* , then:

$$h_i^* = \frac{\sqrt{v_{1j} \cdot v_{2j}}}{\sum_{i=1}^m \sqrt{v_{1j} \cdot v_{2j}}}, i = 1, 2, \dots, m \quad (7)$$

and the calculation formula of the assignment result was:

$$p_1 = \frac{h(u_1, d^*)}{h(u_1, d^*) + h(u_2, d^*)}, p_2 = \frac{h(u_2, d^*)}{h(u_1, d^*) + h(u_2, d^*)} \quad (8)$$

The final weight could be obtained: $W_j = (0.23, 0.16, 0.13, 0.37, 0.1)$. Based on the above results, the author would build System Dynamics model to further verify the weight calculated above.

System Dynamics Verify Analyze

In order to verify the authority of the calculation results of weight above, the author builds System Dynamic model (Figure 2.) based on the institute of system dynamics and China's MSM, and further analyzed the different weight of supervision functions of AD.

Based on Figure 2, fixing the internal working efficiency of enterprises, when AD's administration efficiency was improved and relevant responsibilities were performed well, the enterprise's operation efficiency would be largely improved, and the MSM demand would be further satisfied, so that MSM demand transfer and leakage would be decreased, otherwise the decreasing administration efficiency would affect the demand negatively. Therefore, to analyze the influencing factors and

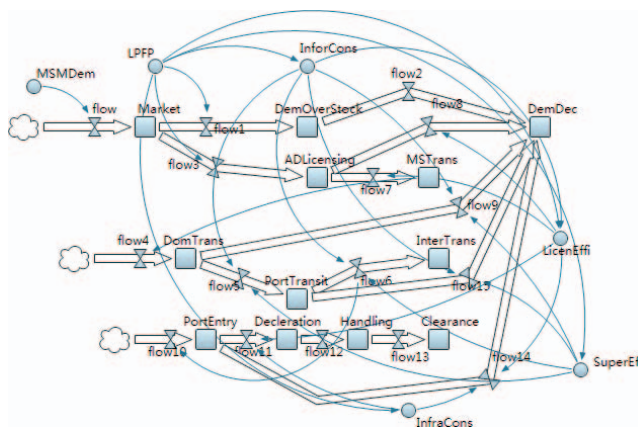


Figure 2. MSM supervision weight verify model.

the influencing rate of the demand decreasing in MSM would further clarify the weight of different AD's administration responsibilities.

From Figure 2, basic calculation principle was:

$$\sum DemDec = MSMDem * (1 - ADEffi) \quad (9)$$

And based on the model:

$$\begin{aligned} \sum DemDec = & MSMDem * (1 - LPFP) + MSMDem * LPFP \\ & * (1 - LicenEffi * LPFP) + MSMDem \\ & * LPFP(LicenEffi * LPFP) \\ & * (1 - SuperEffi * LPFP * InforCons) \\ & + MSMDem * LPFP * (LicenEffi * LPFP) \\ & * (SuperEffi * LPFP * InforCons) \\ & * (1 - InfraCons LicenEffi * LPFP), \\ & (MSMDem > 0, LPFP > 0, LicenEffi > 0, \\ & SuperEffi > 0, InforCons > 0, InfraCons >) \end{aligned} \quad (10)$$

Further Simplified:

$$\begin{aligned} \sum DemDec = & MSMDem - MSMDem * LPFP^5 * LicenEffi^2 \\ & * SuperEffi^2 * InforCons^2 * InfraCons, \\ & (MSMDem > 0, LPFP > 0, LicenEffi > 0, \\ & SuperEffi > 0, InforCons > 0, InfraCons > 0) \end{aligned} \quad (11)$$

Then, considering about the cardinal number of the affecting factors, law and policy revision and abolishment had a close relationship with China's Macro-Situation, which was usually stable and unchanged. Status and regulations revision were usually revised over 10 years from publishing and different direction policies were built after two 'Five-Year-Plan' in China, as the president was usually substituted every 10 years. Under the current administration innovation, China's administrative licensing, inspection and punishment were usually simplified every year, but aiming at MSM, the relevant administration activities optimization were usually happened every 3 to 5 years. Information system construction was

Table 1. Service form index weight statistics.

No.	Service Form	Index Weight (%)
1	Administrative Licensing	23
2	Administrative Inspection and Punishment	17
3	Infrastructure Construction	14
4	Informatization Construction	36
5	Law & Policies Formulation & Punishment.	10

usually in charge of local AD and it could make substantial progress every year, as the data continued growing and was used to analyze the shipping market situation by the government frequently. Infrastructure was widely used in the port and the government was liable for maintaining less than a year to ensure the vessel and cargo could be loaded and discharged normally. As a result, the changing frequency was:

$$LPFP < LicenEffi = SuperEffi < InforCons < InfraCons \quad (12)$$

To unify the changing baseline, the 10-year change benchmark was determined as 'h', the 9-year benchmark was $h^{2^2} \dots$ the 1-year change base was h^{10} , and then substituted from

$$\sum DemDec = MSMDem - MSMDem * h^5 * h^{10} * h^{10} * h^{16} * h^{10}, (h > 0) \quad (13)$$

to

$$\sum DemDec = MSMDem - MSMDem * h^5 * h^{14} * h^{14} * h^{20} * h^{10}, (h > 0) \quad (14)$$

As a result, the weight effect could be regarded as:

$$LPFP < InfraCons < LicenEffi = SuperEffi < InforCons \quad (15)$$

The sequence of factors was almost as same as the weight calculated above.

In the case of the preliminary determination of weight of AD functions, it was established to form the classification table of government regulatory functions (Table 2.), which further refined the government regulatory functions.

Table 2 further clarifies the specific forms of government management functions, as well as the specific impact on enterprise costs. At the same time, the government management functions involved in MSM involve not only one AD, but several ADs, which are further clarified in table 2. In view of government management functions, table 2 further clarifies the current situation of China's MSM by listing typical cases.

RESULTS

According to the government management statement above, the MSM AD Management Process Model is further constructed by methods of Process Optimization and Reengineering (Figure 3.). Process Optimization and Reengineering is usually applied in enterprises structure, and through the change and optimization of internal operation chains and modes, the operation efficiency of enterprises can be improved and internal consumption can be highly decreased (Tarantino and Cernauskas, 2015). The construction of MSM AD Management

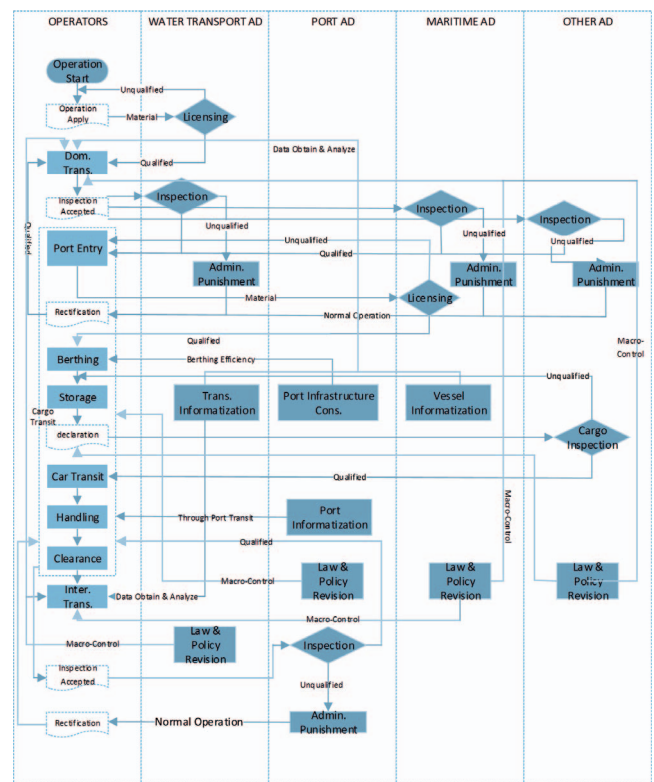


Figure 3. MSM AD management process model.

Process Model and further combing of market activities can refine the relationship between market operators and departments, identify the contradictions between participants, and find the efficiency nodes of market operators, which can further develop the business environment, improve the enthusiasm of enterprises and promote the benign market cycle.

According to Figure 3 and Table 2, the author subdivides AD into four categories, namely, Water Transport AD, Port AD, Maritime AD and other relevant AD. Based on AD's responsibilities division in China, Water Transport AD is mainly responsible for the administration management to the operation activity of inland river and coastal transport, Port AD is liable for the relevant business activities within the port scope, Maritime AD is mainly in charge of ship testing, ship and crew safety administration management, and emergency rescue.

As can be seen from Figure 3, main administration management of MSM was mainly performed by Water Transport AD, Port AD and Maritime AD, while the responsibilities involving other AD are less. There were 5 administration functions which belonged to Water Transport AD, 5 for Port AD, 5 for maritime AD and 4 for the other AD.

Accord with efficiency nodes in Figure 3, there are some problems which may affect the operation cost in China's MSM. Firstly, licensing period might increase enterprises' time cost. The company could only permit into MSM after obtain the qualification by complying with <P.R.C. International Ocean Shipping Act>, and administrative licensing need 30 working

Table 2. Classification table of AD administration.

AD Management Function	Function Classification	Management Form	Affected Enterprise Operation Activity	Relevant AD	Typical Cases
AD Regulatory	AD Licensing	Open the market to enterprises that apply to the business conditions	Enterprise Time Cost (Licensing Time)	Water Trans. AD Port AD Maritime AD, etc.	Accord with <P.R.C. International Ocean Shipping Act> <Rules for the implementation of P.R.C. International Ocean Shipping Act>: To engage in shipping business, an application shall be submitted to the relevant AD under the state council and a license shall be obtained before operation activities which the time limit for the license shall be 30 working days. Accord With <P.R.C. Maritime Transportation Safety Law> <P.R.C. Inland river traffic safety management ACT> The navigation ships in and out of the jurisdiction need to be licensed, and the submitted materials include more than ten items, such as ship profile, general declaration, cargo declaration and crew list. Accord with <Domestic Waterway Transport Management Act> <Domestic Waterway Transport Management Regulation> To inspect the business qualifications and the maintenance of business qualifications of domestic waterway transport operators Accord With <P.R.C. Port Law> Local Port AD shall exercise supervision and inspection to port production safety, and conduct special inspections of the wharves with concentrated passengers, large loading & unloading goods, or special purposes. Accord With <P.R.C. Port Law> The relevant people's governments over the county level shall ensure the necessary capital input for the public waterway, sea wall, anchorage and other infrastructure in ports. Currently, the major port such as Shanghai port and Shenzhen port, is under the responsibility of local port AD for maintenance At present, the Water Transport Bureau belonged to Ministry of transport has established Water Transport Information System, but it only involves the licensing of the Ministry and does not include other licensing information of local AD into the system. Various ports have successively established the information systems, such as Information Service Network of Yangshan Deep Water Port and Guangzhou Port Online Business Office, etc., but the information between them has not realized interaction and sharing.
AD Construction	Infrastructure Construction	Regular inspection and spot check on the market operators	Enterprise Time Cost (Material summary)	Water Trans. AD Port AD Maritime AD	
AD Construction	Infrastructure Construction	Construction of port infrastructure such as port sea lanes, anchorages and breakwaters	Transit Cost	Port AD	
AD Construction	Informationization Construction	Information sharing such as cargo categories, time, equipment automation	Information Obtain Cost	Water Trans. AD Port AD Maritime AD	
AD Marco-Control	Law & Policy Revision	Macroscopic policies, laws and regulations conclude, revise and abolish	Business Environment Cost	Water Trans. AD Port AD Maritime AD, etc.	<P.R.C. Port Law> <P.R.C. Channel Law> <P.R.C. Maritime Transportation Safety Law> <P.R.C. International Ocean Shipping Act> <P.R.C. Inland river traffic safety management ACT> <Ship Safety Supervision Rules>

days. The shipping company must wait for issuing the applicant after submitting the material and it may take longer if the material was not enough or overdue, which highly increased time cost of the company. Before a vessel enters a port, the Maritime AD must license the vessel situation under <P.R.C. Maritime Transportation Safety Law>, and the company had to submit admission materials up to more than 10 items, which seriously affects the operation efficiency. Secondly, different supervision from different AD might develop logistic chain cost. The operator in MSM was supervised by Water Transport AD and Maritime AD during the transportation, and inspected by Port AD, Maritime AD and China's Customs during port transit at same time. Different transportation ways were in charge of different AD with different law enforcement team, which increased the whole logistic cost and decreased competitiveness of China's shipping companies. Thirdly, different information systems increased company's coordination cost. At present, the relevant AD and enterprises almost had their own information system, but with less data sharing and Information interaction, which produced that the operators had to fill information repeatedly under the administration supervision. And less data sharing also affected accurate market analyze and large database construction which had negative effect to data integration in the future. Fourthly, the imperfect infrastructure might affect transit efficiency in the port. According to <P.R.C. Port Law>, the port infrastructure including channel, anchorage, break-water, and so on, was responsible for maintaining mainly by the local port administrative department. However, at present due to the insufficient local government's fiscal, the constrained infrastructure maintenance funds could not support fully maintenance to port infrastructure, which might affect the efficiency of port entry and clearance. Fifthly, law and policy making and revising would affect the business environment of MSM. At present, law and policy of different industry was amended by different AD. However, in the process of amending, the department always fully consulted the opinions from other AD, but less participation by the operators, which might produce that the current market problem could not be reflected by the published law and policies. As a result, the applicability of law and policies decreased and could not totally solve the current market problem, which also affected the enthusiasm of enterprises to take part in formulating laws and regulations.

DISCUSSION

Constructing MSM AD Management Process Model above, AD management problems could be found and to solve current problems, the author would further build MSM AD Management Process Optimization Model (Figure 4.), put forward the direction and method to solve these problems.

Research Result

According to Figure 4, comparing with Figure 3, the administration management was simplified in order to decrease administration barriers. Considering about the administration functions, there were 3 function for the whole comprehensive transport department and 3 for all relevant

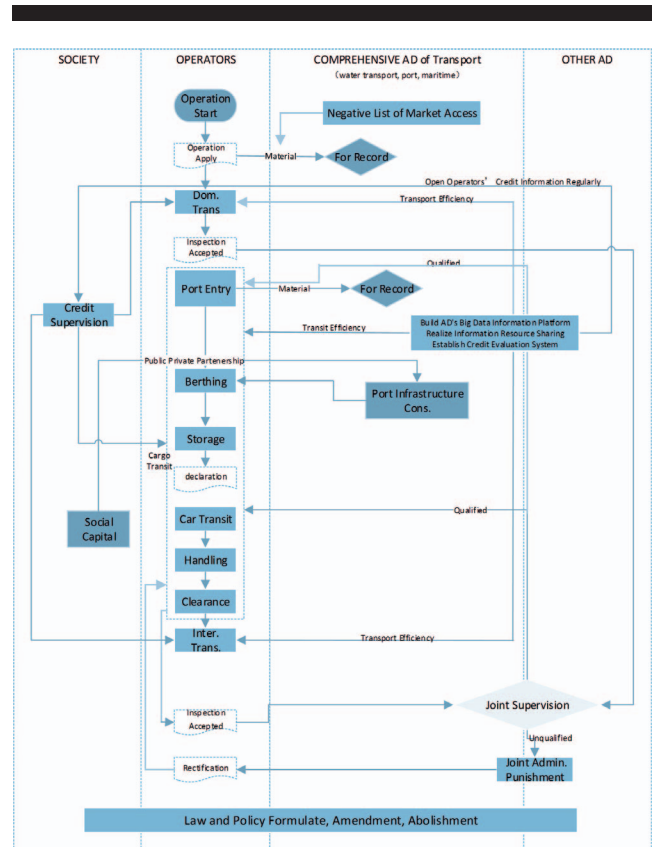


Figure 4. MSM AD management process optimization model.

AD. The supervision burden was widely released and department was further integrated.

Corresponding to the foregoing questions, the first one was to reduce administration licensing, and strengthen supervision afterwards. General cargo transport influenced less on public security, and it should be considered to cancel general cargo international transport approval and general cargo to port approval in China. Register System could substitute Approval System to override barriers of market access and operators did not to interrupt the business activities by submitting the materials to AD for the registration. The Negative List of MSM Access should be constructed to clarify the entry barriers, in order to decrease the preparing time. Secondly, integrating transportation AD law enforcement team could increase administration efficiency in MSM. Water Transport AD, Port AD and Maritime AD belonged to the category of Ministry of Transport, and to avoid repeatedly, inefficiently administration management, the AD should further integrate the enforcement team and coordinated enforcement power. As a result, a high-efficiency, uniformed and unified team should be showed to perform administrative inspection to increase operation efficiency. Thirdly, information system from different AD should be merged together to promote information interaction and data sharing. The local government should build government administration platform and summary all the MSM information from the existing system, so that the

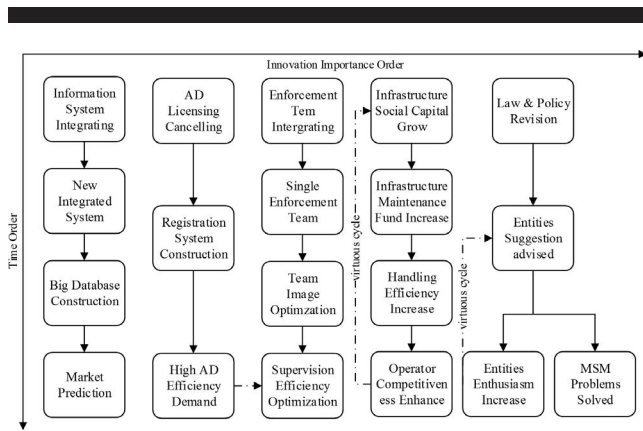


Figure 5. MSM AD innovation biaxial model.

operators did not need to fill information repeatedly and MSM large database could be constructed with sufficiently information to predict the market accurately and help the operators to avoid market risk (Mayer and Viktor, 2013). The system could also help transport AD to realize the market dynamic in time. Considering credit application, the system should renew operators' credit conditions regularly to strengthen the social supervision and reduce the pressure of AD. Fourthly, optimize the financial model for port infrastructure. With the entrance of social capital, the new public private partnership modes would be formed and infrastructure could obtain maintenance funds both from the government and users, which could form a virtuous cycle that regular infrastructure maintenance could improve port handling efficiency, which could decrease operation cost and increase competitiveness, and could further inspire operators to invest in infrastructure. The fifth one was reformation on policies and regulations amendment. In the formulation of policies and regulations concerning the practical interests of enterprises, the suggestions of enterprises and industry associations and Chambers of commerce should be advised. The consultation mechanism should be established to further stimulate the participation of business entities in the revision of policies and regulations, as to improve the applicability and operability of policies and regulations.

Research Limitation

There are limitations in this research. Firstly, the models above were constructed based on the transportation chain from domestic to international transport, rather than discussing other situation such as international to domestic transport, international to international transport, etc., as different transportation chain was managed in different ways and could not be fully discussed specifically. Secondly, the author was focus on water transportation and did not discuss other transportation ways, which was not able to consist the whole transportation chains. Thirdly, the question solutions discussed above were not quantified and need to be further refined in the following research. The author would combine the above research limitations and continue to conduct in-depth research on the improvement of government management efficiency of the port.

CONCLUSIONS

Considering about the human cost and fiscal costs of China's government, the innovation could not be finished all together and the key tasks should be developed first. The calculation of AD management function weight could certain the importance of five different transport AD functions, and the process optimization model could be regarded as the reference for the innovation questions and solutions.

Figure 5 describes the innovation importance order and time order of MSM. Accord with Figure 5 above, firstly, AD should promote the construction of information system by integrating existing information system and breaking down data barriers. The new system could strengthen data interaction and information sharing as the base of Big Database, which could be applied to predict the market and deal with sufficiently emergency preparedness. Secondly, AD licensing should be cancelled for general cargo at first, while Negative List of MSM Access could be built at same time and Record System should be built to simplify market access. As a result, high efficiency AD supervision was needed in the future. Thirdly, the comprehensive law enforcement should be promoted and law enforcement team from different transport AD should be integrated into one team to form single law enforcement. The integrated team could improve regulatory efficiency and uniformed team could develop the image of law enforcement, which could satisfy the demand of supervision after cancelling approval. Fourthly, social capital should be actively introduced into port infrastructure construction to strengthen the maintenance and optimization of port infrastructure in the form of joint investment by enterprises and the government. Perfect port facilities could increase port operation efficiency, which could develop the transit efficiency in the whole transportation chain, and enhance operator's competitive force as a result. Developing working efficiency could promote the operator to invest infrastructure initiatively and form virtuous cycle. Fifthly, in the process of drafting and formulating relevant administrative documents including policies and regulations on enterprises, amendment department should fully absorb the suggestion of business entities by building consultation mechanism, further promote scientific and democratic decision-making, and promote the construction of law-based government.

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