

## Evaluation and Improvement of Shipbuilding Capability of China

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### Abstract

*There are many thorny problems in our country, such as the security of sea lanes. To deal with these problems, China needs to develop sophisticated naval force, and warship industry is the key factor to improve Chinese navy. Chinese warship industrial capacity is evaluated by using the assessment system. According to the results and existing researches, strategies for improving Chinese shipbuilding industry capability is built from five aspects. It is the reference to strengthen Chinese warship industrial capacity, improve navy's core competence, thus secure Chinese territory and marine economy.*

**Keywords:** ship industry; warship industry; assessment system; index system

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### 1. Introduction

In recent years China has been confronted with sea route security problems. The solutions depend on great navy force, which in turn lies on the development of shipbuilding industry, and it's also an important measure for achieving maritime strategies. Chinese shipbuilding industry has made great progress, ranking NO.1 in the world by exceeding Japan and Korea. However, it is limited in the amount of shipbuilding tonnage, and in terms of the key equipments, China still relies on imports, lacking competition capability. Moreover, as for the division of shipbuilding industry, China takes the leading position in civil aspect but lags behind in that of military. In particular, scientific research and production of large ships still cannot meet the needs of Chinese maritime and national defence strategy. As a consequence, it's extremely urgent to improve the shipbuilding ability of China.

### 2. A Review on the Studies of Chinese shipbuilding Capability Evaluation

#### 2.1. Shipbuilding Capability Evaluation Approaches

There is not much systematic literature on the shipbuilding industry capability abroad and at home. The studies mainly focus on its important roles in accelerating the shipbuilding capability based on a country's current situation with smaller length (Wenqing Yan, 2011) [1]. U. S. Navy Lt. Commander, Wayne Hugar (2001) published an article on *USA Naval Academy*, in which he analysed the role of shipbuilding industry played in promoting the scientific research and production of ships in China [2]. Pavel Mikhailov, 2005, surveyed the shipbuilding capability of Russia from its history, organization structure, research system and the ships being studied or developed [3]. Rand Corporation (2005) presented a report to the US Department of Defence, which reviewed the development of Chinese Shipbuilding Industry and its accelerating function in ship design and production based on the organization structure and system, including its faculty, facilities, equipment, ships built, scientific system and so on [4].

Vladimir Shcherbakov, 2007, analysed the scientific development and construction capability of Russia from its scientific research system, shipbuilding capability, future direction, the ships being studied and developed, etc [5]. Guangwen Chen (2009) measured the military shipbuilding capability of Japan from the number of shipbuilders, the amount of ships built, the various types and its scientific research system [6]. Peng Lin (2004) studied military potential of

Japanese shipbuilding industry from its economic basis, shipbuilding ability, scientific research system and scientific research level [7]. Zhi chao xu (2009) have been discussed about Russia's ship industry ability of industry and product structure, organization management, ability and level [8]. Yanshou (2010) surveyed Japanese submarine industry from its design ability, nuclear technology reserve and shipbuilding techniques [9]. From the above review it's found that the scholars approached the shipbuilding ability from different angles, but an evaluation system to measure the shipbuilding capability has not been set up until now.

## 2.2. Construction of a Indication System to Evaluate Chinese Shipbuilding Capability

Considering the confidentiality of shipbuilding industry, it's difficult to obtain the measurement indicators and results of each country. In order to achieve a much more accurate evaluation in China, the author interviewed 15 famous experts in the shipbuilding area to obtain the main indexes adopted in evaluating Chinese shipbuilding capability. The interviews mainly centered on the question, that is, "*what elements do you think can demonstrate or affect the shipbuilding capability of a country?*" The elements presented by experts are illustrated as follows.

The data collected from the interviews are coded so as to be analysed systematically. Taking the open question into consideration, the data are manually coded. In order to grasp the essence of the data, the author invited an executive of a company and an on-job doctorate (also a chief manager in a company) to be involved in the coding stage. First, the author and the doctor of management abstract and summarize the key elements independently and simultaneously. If both of them classify one element in a category, it will be analysed in the second stage. If the classification is not the same, the executive will be involved to discuss about it. Until a consensus is reached does the analysis come to the statistic stage. According to the open coding of the interview data, it's found that three types of elements, in general, represent a country's shipbuilding capability, that is, scientific research and development ability, ship building ability and international cooperation ability.

Table 1. Shipbuilding Industry Capability Evaluation Index System

No.	Interviewer's Description (Indicators)	Grades	Code
1	National Basic Scientific Research Level (10)	5、4、3、2、1	Scientific Research and Development Capability
2	Amount and Distribution of Shipbuilding Research Institutions (8)	5、4、3、2、1	
3	Amount and Distribution of Shipbuilding Researchers (7)	5、4、3、2、1	
4	Shipbuilding Research Experience (5)	5、4、3、2、1	
5	Technological Input (5)	5、4、3、2、1	
6	National Basic Industry Level (8)	5、4、3、2、1	
7	Amount and Distribution of Large or Medium-sized Shipbuilders (6)	5、4、3、2、1	Shipbuilding Capability
8	Amount and Distribution of Shipbuilding Equipment and Facilities (9)	5、4、3、2、1	
9	Amount and Distribution of Shipbuilding Technicians (4)	5、4、3、2、1	
10	Shipbuilding Technique level (7)	5、4、3、2、1	
11	Shipbuilding Efficiency (6)	5、4、3、2、1	International Cooperation Capability
12	Localization Rate of Ship Weapon (5)	5、4、3、2、1	
13	Policy and Finance Support Degree (5)	5、4、3、2、1	
14	Foreign Technique Introduction Degree (4)	5、4、3、2、1	
15	International Cooperation Shipbuilding Capability (8)	5、4、3、2、1	
16	Capability of Purchasing Ship-weapons from Foreign Countries (3)	5、4、3、2、1	

**Data source:** summed up by coded data based on the interviews, the number in the bracket behind each indicator refers to the weight of them.

The present study adopts the expert argumentation method, inviting some scholars to weight the above evaluation indicators anonymously. In order not to separate from the practice, the experts group is composed of executives of shipbuilding corporations, experts, professors and scholars in national defence industry. The weight of each indicator is identified by experts

after repeated discussions according to the characteristics, practical situation and relevant studies of the shipbuilding industry. The indicators are divided into 5 ranks, that is, very good, good, just so so, bad, very bad, each with the corresponding grade ranging from 5 to 1. The evaluation procedure goes like that if one of the indicators is judged as very good, the grade is 5 [10], [11].

It should be noted that the indicators cannot be made specific as a result of the particularity of shipbuilding industry. They can only be judged based on the appraisers' experience and ranked with corresponding grades, which are calculated to get a weighted average number.

### 2.3. Evaluation Results and the Analysis

#### Selection of Experts

In consideration of the particularity of shipbuilding industry, some data is not available, so experts who are familiar with Chinese shipbuilding industry are selected. Moreover, the appraisers are choosed by referring to the 360 degree evaluation method. They generally include military officials (purchasers), providers of core components, executives of shipbuilders, military dynamic observers, researchers of shipbuilding industry (college scholars), researchers in the field of shipbuilding industry (brokers) and researchers of the management .

Two appropriate appraisers are selected from the rest 7 ones except the author to conduct a further evaluation, and the scores they give are averaged, which finally comes out as the evaluation result.

#### Evaluation Results and the Analysis

The evaluation results are handled by way of statistics according to the previously determined evaluation principle. Taken as a whole, there is no big difference between the 14 experts' evaluation results and that of the author, fluctuating in a certain range. In general, the shipbuilding industry capability of China is scored as 73.0, which suggests that China is at a medium level and that there still exists a large gap when comparing with advanced countries. Generally speaking, measures should be taken to promote the shipbuilding industry in China. To be specific, compared with the shipbuilding ability of China, its international cooperation capability is still relatively compromised, and the research and development level is supposed to be taken further.

Table 2. Statistical Table of the Evaluation Results

Levels	No. (Indicators)	Weight of the Indicators														Author	Average
		A	B	C	D	E	F	G	H	I	J	K	L	M	N		
Scientific	1	3	4	4	3	4	3	4	4	4	3	4	3	2	4	4	3.5
Research and Development	2	4	4	4	3	3	4	4	3	3	4	3	4	3	4	4	3.6
Capability	3	3	3	4	3	4	4	3	3	3	4	4	4	3	4	3	3.5
	4	3	3	3	2	3	3	4	4	3	3	4	3	3	4	3	3.2
	5	4	3	4	4	3	4	3	4	4	3	3	3	4	4	4	3.6
	6	3	4	3	4	4	4	3	3	4	3	4	4	4	4	4	3.7
	7	5	4	4	5	3	4	5	3	4	5	5	4	4	3	5	4.2
	8	4	4	3	5	3	3	4	3	4	4	5	4	4	3	4	3.8
Shipbuilding	9	5	5	5	4	4	5	3	3	4	5	3	4	5	4	5	4.3
Capability	10	3	4	5	4	4	5	4	4	4	5	4	5	4	4	5	4.3
	11	4	4	4	5	4	4	4	3	4	4	5	4	4	5	4	4.1
	12	4	4	4	5	4	4	4	3	4	4	5	5	5	4	5	4.3
	13	5	4	4	5	3	3	3	3	4	5	4	4	4	4	4	3.9
International	14	3	3	2	3	2	3	3	3	3	2	2	3	3	3	3	2.7
Cooperation	15	3	3	3	2	2	3	3	3	3	3	3	2	3	2	2	2.7
Capability	16	3	2	2	3	2	2	3	3	2	2	2	3	3	2	2	2.4
Mean Number		73.2		74		69.6		69		73.4		75.6		72		76.8	
Total Average		73.0															

**Notes:** the data is processed according to the statistical results. A and B are the military officials (purchasers); C and D are providers of core components; E and F are executives of shipbuilders; G and H are military dynamic observers; I and J are researchers of shipbuilding industry (college scholars); K and L are researchers in the field of shipbuilding industry (brokers); M and N are researchers of the management. For comparison's sake, the ultimate result adopts the centesimal system.

### 3. Strategies for Improving Chinese Shipbuilding Industry Capability

#### 3.1. Main Factors Affecting the Improvement of Chinese Shipbuilding Ability

The overall capability of Chinese shipbuilding industry shows a striking increase in these years, however, there is still a relatively large gap compared with the advanced countries. China falls behind them in the following aspects like the comprehensive competition abilities, industrial organization structure, ship building scientific and technological level, ship equipment industry, corporation management and support policy. It's analysed in detail as follows:

**Shipbuilders are distributed inappropriately with uneven development and low concentration degree.** It is of great significance for each country to improve their international competition ability by optimizing the industry structure to form scale economy and to build a orderly, competitive development environment. At present, many problems still exist in the industrial structure of Chinese shipbuilding industry: there is no corresponding competition system and the productions are uncompetitive in international markets; scale economy cannot be formed due to its low concentration degree.

**Technological level is low in general; design and shipbuilding technique falls behind.** Ship building industry has been expanded to Top 1 in the world in recent years and its technological level is also improved in a degree. However, Chinese shipbuilding industry still lags behind the advanced level of the world due to its weak ability of basic scientific research and development, insufficient ability of designing high-end ships and relatively backward designing and manufacturing techniques.

**The development of ship equipment is backward.** There remains a convention that shipbuilding is overweighted than developing its corresponding equipment in the long history of Chinese ship equipment industry. In addition, China has long paid more attention to introducing techniques than absorbing them. Its neglecting the cultivation of self-development ability leads to Chinese ship equipment industry lacking self-development ability and unable to produce equipment with independent intellectual property. With the development of science and technology, the originally introduced technique can no longer meet the needs of contemporary age. The corresponding equipment and the technology cannot be updated in time, and the localization rate of the equipment is in decline every year.

**The management of shipbuilders is supposed to be promoted.** The biggest difference between Chinese shipbuilders and that of foreign countries' is the corporation management level at present. Comparing with the advanced countries, Chinese shipbuilders are backward in the management mode, approach and technology. The efficiency of shipbuilding corporation cannot be played completely, with disproportional rate between the technology equipment input and output. The backward management level directly leads to the inefficiency of shipbuilders, low quality of the productions, low international competitive ability of the products, which all hinder the further development of Chinese shipbuilding industry.

**Institutional mechanism and policy environment needs further perfection.** Chinese shipbuilding research and development corporations are all state-owned enterprises, which universally have various problems, for instance, the institutional mechanism is inflexible and inelastic; the corporations are overburdened with excessive staff; the construction of modern enterprise institution keeps a slow pace. Besides, the corporations didn't get sufficient and systematic support from the government policy and other aspects. Whether from the depth or the breath, the policy support needs to be further improved.

#### 3.2. Strategies for Improving Chinese Shipbuilding Industry Capability

**It needs to improve the foundation ability of national defense scientific and technological industry.** As a major part of Chinese national defense scientific and technological industry, shipbuilding industry is closely associated with its overall development and lays foundation for it. Accordingly, the national defense scientific and technological industry capability should be put into a dominant position by implementing the military to civil strategy. In this way, it can get financial support to improve its rapid mobilization capability.

**It needs to boost the improvement and innovation of shipbuilding.** Innovation and creation is the soul of a nation and the unexhausted power for its development. Scientific and technological innovation must be promoted to develop high-tech warship equipment and to enhance shipbuilding industry level. As a consequence, the following approaches are proposed: to promote technological innovation, to enhance ship design level, to make a breakthrough in basic, generic and core techniques, to construct an innovation platform, to drive information by

industrialization, to accelerate shipbuilding industry technological transformation, to improve self-development of ship types [12].

**It needs to seep up the adjustment of industrial structure and optimize the industrial distribution.** The industrial structure needs to be adjusted and the industrial distribution needs to be optimized according to the features of the shipbuilding industry. First, the organization structure needs to be adjusted by setting up international enterprises of first-class and large-scale, by constructing professional and characteristic shipbuilding industry and by developing modern ship production and service industry. Secondly, an effective shipbuilding system should be constructed to improve the assembly shipbuilding level and the lean shipbuilding. Digitalization shipbuilding ability needs to be enhanced and a cooperated assembly shipbuilding model needs to be set up. A professional and divided cooperation system of the middle product should be actively developed in different sections, unit models and outfitting, etc. What's more, green shipbuilding level also needs to be improved in an effort to set up a green, effective, economical and modern system. Thirdly, the industrial distribution should be optimized by adjusting ship building and repairing capacity. In addition, maritime engineering equipment and building industry should be concentrated to render the key equipment building base bigger and stronger. Fourthly, the important area guides the development of ship repairing and corresponding equipment industry.

**It needs to enforce the management of ship industry.** Shipbuilding industry concerns a country's strategic interests. Consequently, the supervision and management should be strengthened. Firstly, the industry quality evaluation and supervision can be strengthened by further regulating the market order, by improving the industry admission rules and management system and by severely implementing industrial policies. Secondly, the industry quality, safety management and control should be promoted. Thirdly, shipbuilding industry should be given more finance support, with thorough financial policy support. Fourthly, the opening-up level should be increased to introduce advanced ship equipment, technological knowledge, talents, facilities and management method, and the cooperated development of high-end ships needs to be carried forward. Fifthly, the construction of legal rules and laws should be accelerated by strengthening the legislation of research and development activities. In this way, a favorable systematic environment will be created, solidifying the research, production and management results.

**It needs to improve the scientific management level of shipbuilding industry.** Chinese shipbuilding industry should convert from the original extensive development mode to a connotative mode. A modern corporation system should be constructed to improve the scientific decision-making and management level. Firstly, it should focus on developing three mainstream ship types like bulk carriers, oil tanks and container ships, and on high-tech ship fields with superior foundation and greater market needs. Moreover, shipbuilding industry should create well-known brands with low-cost, high quality, super comprehensive technical and economical performance so as to lead the market needs. Secondly, professionals should be cultivated and faculties be trained in order to improve the overall quality and meet the sustainable development needs of the ship industry. Thirdly, the strategy of "bringing-in" and "going out" is carried out by strengthening the cooperation and contact with international organizations, main shipbuilding countries (especially the countries with advanced techniques ) and by taking part in the legislation and modification of specification standard.

#### 4. Conclusion

According to the evaluation results, it's found that Chinese current shipbuilding industry capability is still at a middle level, but there still exists a large gap compared with the advanced countries. As for shipbuilding capability, the international cooperation ability is still comparatively weak, and the research and development level needs to be further improved. In comparison with advanced countries, China still lags behind in such aspects as comprehensive competitive abilities, industrial organization structure, technological level, ship equipment, corporation management and policies. The industry distribution is not appropriate, with low concentration. The overall scientific and technological level is low with inadequate design and production technology and backward ship equipment industry. Moreover, the management needs to be improved, and so does the institutional system and policy environment. If corresponding measures are taken to the above problem, Chinese shipbuilding industry capability will be

effectively improved and Chinese defence and maritime strategies will be achieved. As China is strong in the field of civil shipbuilding, it has become No. 1 shipbuilding country in the world by exceeding Japan and Korea, which lies a favorable foundation for China to improve its ship production ability. Only if China achieves its conversion from civil shipbuilding to military shipbuilding and expands the transformation channel can Chinese shipbuilding capability be greatly promoted.

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