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Research on the method of seafarers' competence assessment in China based on Delphi Method and Swot Analysis

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RESEARCH ON THE METHOD OF SEAFARERS' COMPETENCE ASSESSMENT IN CHINA BASED ON DELPHI METHOD AND SWOT ANALYSIS

by

Fan Lei

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(MSEM)

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DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature):

(Date):

Supervised by: .
Supervisor’s affiliation:

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ABSTRACT

Title of Dissertation: Research on The Method of Seafarers' Competence Assessment In China Based on Delphi Method and Swot Analysis

Degree: **Master of Science**

The dissertation is a study of the method of the seafarers' competence assessment in China.

The international convention on seafarers' assessment and some sample countries' practices are studied. It is found that the methods of seafarers' competence assessment is vital to the maritime safety. However, the convention leaves some blank on the methods to be used during the assessment. The specific practice vary in different countries.

The management system of seafarers' competence assessment falls in rule based rule, which limits the innovation of maritime education and training institutions. The assessment is carried out by MSA alone. METs and employers do not have enough say on it. Through questionnaire interview review and analysis, the method of seafarers' competence assessment in China is found lack of reliability, validity and discrimination. The theoretical part is too heavy.

The dissertation also studied the regulations on applying simulator in the process of assessment and the research of authentic assessment. Then, the author proposed recommendations of adjusting the management toward GBS mode, establishing 3-party operating mode, and promote contextualized assessment to optimize the practice in China.

KEY WORDS: Seafarer; Competence Assessment Method; GBS

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LIST OF ABBREVIATIONS

BRM	Bridge Resource Management
BIMCO	The Baltic And International Maritime Council
COC	Certificate Of Competence
CMSA	China Maritime Safety Administration
DNS	Diploma In Nautical Studies
ECDIS	Electrical Chart Display And Information System
ERM	Engine Room Resource Management
GBS	Goal Based Standard
ICS	International Chamber Of Shipping
IMO	International Maritime Organization
MET	Maritime Education And Training Institutions
MSA	Maritime Safety Administration
MOT	Ministry Of Transport
MNTB	Merchant Navy Training Board
ME	Maritime English
OOW	Officer Of Wathckeeping
RBR	Rule Based Rules
STCW	International Convention On Standards Of Training, Certification And Watchkeeping For Seafarers
SIRC	Seafarers International Research Center
VR	Virtual Reality
WSE	Wuhan Shipping Exchange

CHAPTER1 INTRODUCTION

1.1 Background

China currently has the largest number of registered seafarers. According to the report of China’s seafarer development 2019 issued by MOT in 2020, by the end of 2019, China had a total of 784,355 registered seafarers. At the same time, China's maritime education and training continues to grow. In 2019, 19,526 students enrolled in China's navigation major, increasing by 12.5 percent year-on-year. In the same year, a total of 182,962 person·time jointed the competence assessment, increasing by 37 percent year-on-year.

The STCW78 Convention formally came into force in 1984, and China was the original contracting party of the Convention. With the amendment of the STCW Convention, China has revised its administrative measures for seafarers’ competence assessment for many times, successively issuing "79 Measures", "87 Rules", "97 Rules", "04 Rules" and "11 Rules".

From 2011 on, in order to implement the Manila amendment to the STCW 78/95 Convention, China has adjusted the mode and content of seafarers' training and assessment to meet the requirements of the Convention. The maritime administrative authorities have actively explored the way of seafarers' competence assessment, and constantly tried to improve the objectivity and accuracy of seafarers' competence assessment by adopting new scientific and technological methods. But, up to now, the assessment of seafarers' competence has no obvious effect on the improvement of Chinese seafarers' skill level and overall quality. Human factors are still the main

cause of maritime traffic accidents of Chinese ships (CMSA, 2018). At the same time, The overall international competitiveness of Chinese seafarers has no advantage. In particular, senior seafarers who perform ship management and operation are at a disadvantage in the competition with seafarers from the Philippines, India and other countries. Seafarers with certificates of competence of seafarers under the Chinese regulations mainly serve ships registered in their own countries(CMSA, 2020).

1.2 Objectives of research

The primary objective of this thesis is to analyze the seafarer's competence assessment method in China, clarify the status quo, distinguish the advantages, disadvantages, rationality and find the improvement direction of the current method of Chinese seafarers' competence assessment methods.

Based on study of relevant new researches and technologies, this thesis also aims to give some more targeted suggestions about the development of China's competence assessment methods.

1.3 Methodology

The research adopted Delphi method, collected information through questionnaire, interviews and literature review. The object of questionnaire and interview includes Chinese seafarers, maritime majors, teachers or faculties engaged in management issues of METS, the managers of shipping companies and seafarers' agencies and maritime administration officers.

The analysis of seafarers' competence assessment is conducted based on SWOT model, focusing on the weakness (shortcomings) of current China's method of seafarers' competence assessment.

1.4 Structure of dissertation

This dissertation consists of seven chapters.

Chapter Two studies requirements of the international conventions on seafarers competence assessment and its development, the status of seafarers quality all over the word and its impact to the safety at sea, the main international seafarer supply states and some countries' practice of seafarers' training and assessment. Chapter Three focuses on the Chinese seafarers' competence assessment method. Chapter Four analyzes the seafarers' competence assessment method through "4 natures" and questionnaires. Chapter Five studies researches on seafarers' competence assessment method and the future utilization of new technologies in the process of assessment. Chapter Six proposes some recommendations. The last chapter is the conclusion.

CHAPTER 2 THE DEVELOPMENT AND STATUS OF INTERNATIONAL CONVENTIONS ON SEAFARERS ASSESSMENT

2.1 STCW

2.1.1 Implementation and development

Maritime accident will cause great damage to the safety of human life and the Marine environment. Investigations into maritime safety accidents have shown that inadequate competence of ships and their equipment is usually the main cause of maritime accidents (Pecota,S.R. & Buckley, J.J., 2009). In order to strengthen the safety of life and property at sea and the protection of Marine environment, the International Maritime Organization (IMO) issued the International Convention on Standards for Seafarers' Training, Watchkeeping and Certification (STCW) on July 7, 1978, aiming to establish the basic requirements for seafarers' training, certification and watchkeeping that are widely recognized by the international community. The Convention entered into force on 28 April 1984 and underwent two major amendments in 1995 and 2010 respectively (IMO, 2020). In order to achieve this goal, IMO has established a common minimum standard for seafarers' certification of Competence, which provides guidance for METs to conduct competence assessment for seafarers through a standardized competence assessment system, which serves as the basis for the issuance of competence certificates for seafarers (Ghosh, et al., 2014). As seafarers are a global profession, before the STCW Convention comes into force, the standards for seafarers' training, certification and watchkeeping are formulated by the relevant countries themselves, while the standards formulated by each country are usually different from each other, leading to wide differences in the standards and certification procedures for seafarers' competence (IMO, 2020). The STCW Convention has undergone two major revisions. In 1995, in order to keep the

convention in line with reality and eliminate gaps already identified, the IMO first revised STCW. In 2010, in order to maintain the consistency between the Convention and industry development and solve the expected problems, IMO made a major revision to the Convention again and called it the Manila Amendment to the STCW Convention 78/95.

2.1.2 Minimum competence standard

Regulation I/2 of the Manila amendments to STCW Convention 13.5 provides that an application for a COC shall meet the standards of competence set out in the rules for the capacities, functions and levels specified in the endorsement of the certificate. The functions specified in the standards of competence are divided into seven categories: Navigation, Cargo handling and stowage, Control of ship operation and care of personnel on board, Marine engineering, Electrical, electronic and control engineering, Maintenance and repair, and radio communication. There are three levels of responsibility: management, operational, and support. The STCW code classifies the minimum standards of competence according to the level of function and responsibility for duties to be performed on board (see Table 1, for example, senior seafarers on ships of 500 gross tons or above who are responsible for navigation and watch)

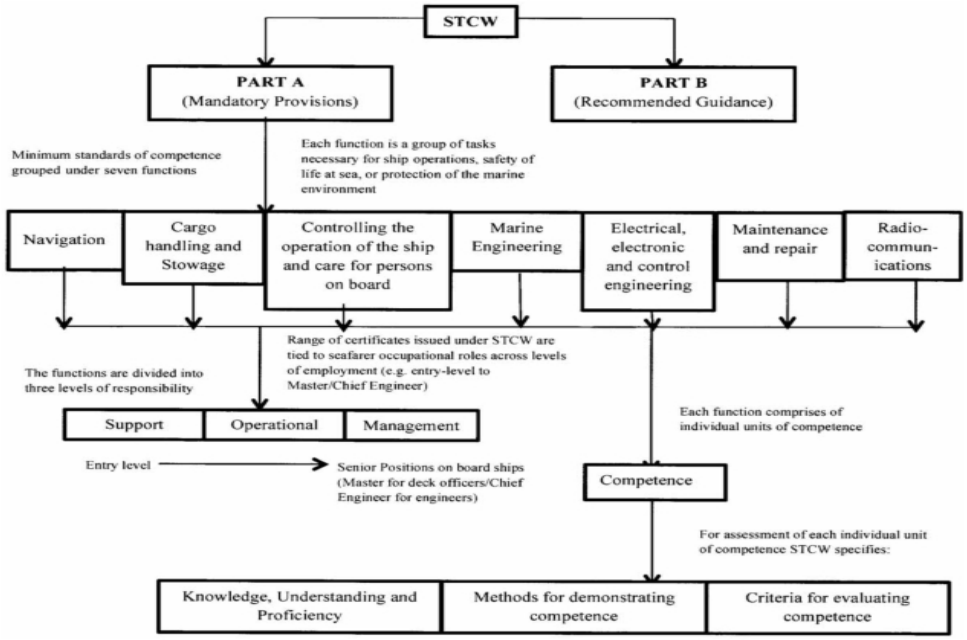

Figure1: Standards of competence and assessment in STCW as amended

(Source: Samrat Ghosh et al., 2014)

Table 1: Specification of minimum standard of competence for officers in charge of a navigational watch on ships of 500 gross tonnage or more

Function ： Navigation at the operational level

Competence	**Knowledge, understanding and proficiency**	**Methods for demonstrating competence**	**Criteria for evaluating competence**
Respond to a distress signal at sea	Search and rescue Knowledge of the contents of the international aeronautical and maritime search and rescue (IAMSAR) manual	Examination and assessment of evidence obtained from practical instruction or approved simulator training, where appropriate	The distress or emergency signal is immediately recognized Contingency plans and instructions in standing orders are implemented and complied with

Source: IMO, The Manila amendments to STCW convention

According to the provisions of STCW, there are two kinds of suitable methods for

demonstrating competence, theoretical examination and assessment. And the evaluation content is divided into evidence obtained through training and work experience. But it is up to each member state to decide the procedure and specific tools for conducting the assessment. The STCW code A-I/6 provides that each Member shall ensure that all training and assessment of seafarers applying for certification under the Convention shall be carried out, monitored, evaluated and supported by qualified personnel in accordance with the Convention to ensure that the minimum standards of competence under the Convention are met.

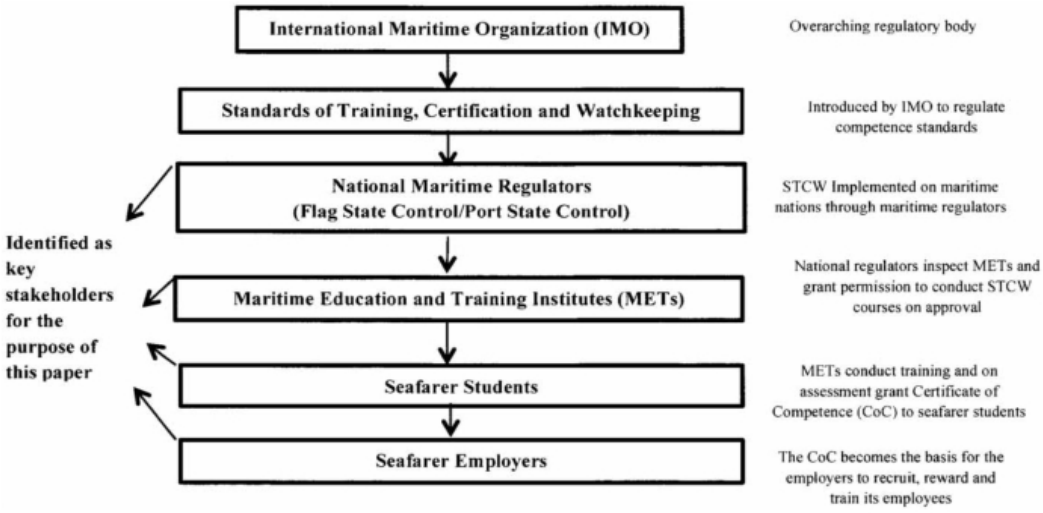

Figure2: The role of the key stakeholders in the implementation of STCW
(source: Samrat Ghosh et al., 2014)

2.2 Global status of seafarers and their quality

Today, more than 1.6 million seafarers worldwide serve on international merchant ships. China, Philippines, Indonesia, Russia and Ukraine are the five major suppliers of international seafarers in the world (ICS, 2017).

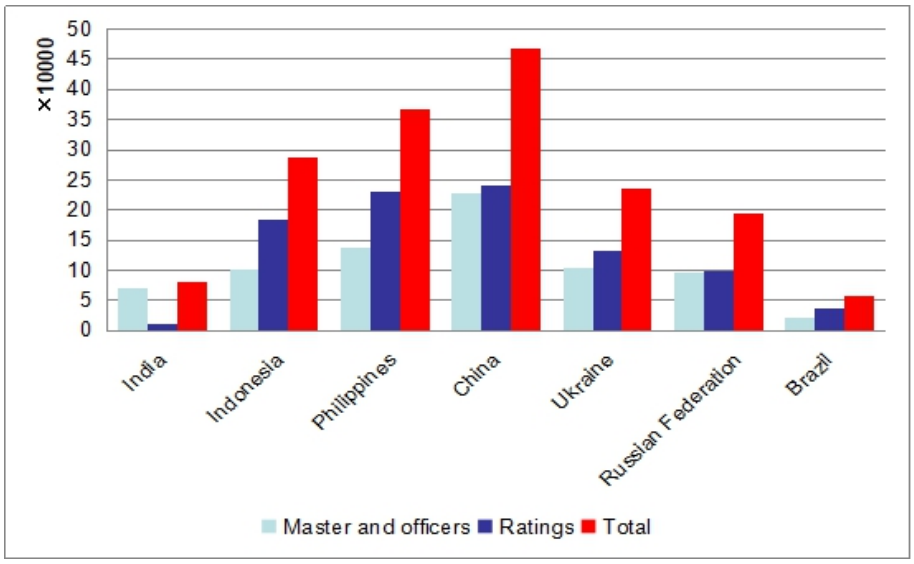

Figure3: The seafarer supply state
(Source: BIMCO & ICS, 2015)

Because the STCW convention as amended does not have a fixed method for assessing the competence of seafarers, the methods of determination of seafarers' competence are not uniform in different countries. A study by Samrat Ghosh and his partners showed that the current assessment methods used in various countries are flawed and need to be improved to meet the expectations of stakeholders, and that there is insufficient evidence in the assessment process to show that the candidates are capable of performing in different environments and situations. The current methods of seafarers' competence assessment generally fail to effectively separate the learning and assessment process of candidates. The current assessment methods are generally lack of conditions for effective combination of assessment tasks and practical work and excessively rely on the examination of the candidates' knowledge memory(Ghosh, S. et al., 2014).

Over the past few decades, maritime safety has been greatly enhanced by a combination of technological advances, training advances and institutional improvements (Allianz, 2012). However, seafarers are still one of the most

dangerous professions in the world (Borch et al., 2012). At the same time, human factors are also the primary and main cause of maritime traffic accidents. Human error continues to be a major driver of incidents (AGCS, 2018). IMO statistics show that 80% of maritime accidents are caused by human factors. Human error remains a key safety issue and an underlying factor in many claims, meaning the quality of seafarer and ship owners' overall safety culture are of increasing importance to risk assessment (AGCS, 2019). Seafarers' over-reliance on scientific and technological products is becoming increasingly serious. There have been many cases of accidents caused by over-reliance on scientific and technological products by duty seafarers (Allianz, 2018). Up to now, the quality and skill level of seafarers around the world has not been embodied in the guarantee and improvement of maritime traffic safety. There is no obvious effect on the assessment and promotion of seafarers' competence by the current competence assessment methods.

Apart from third-party defects, weather and environmental causes, fatigue, design defects, insufficient manning, lack of construction guidelines, technical failures and overload factors, all the other factors that lead to maritime accidents are related to seafarers' competence, and always occupy the main content of maritime accident inducements. A study published by SIRC shows that the major factors leading to maritime accidents between 2002 and 2016 are almost all related to human error (see Figure 4) (Acejo et al., 2018). It can be seen that there is a lack of unified assessment methods for seafarers' competence globally, and the role of assessment in verifying and promoting seafarers' competence needs to be further improved.

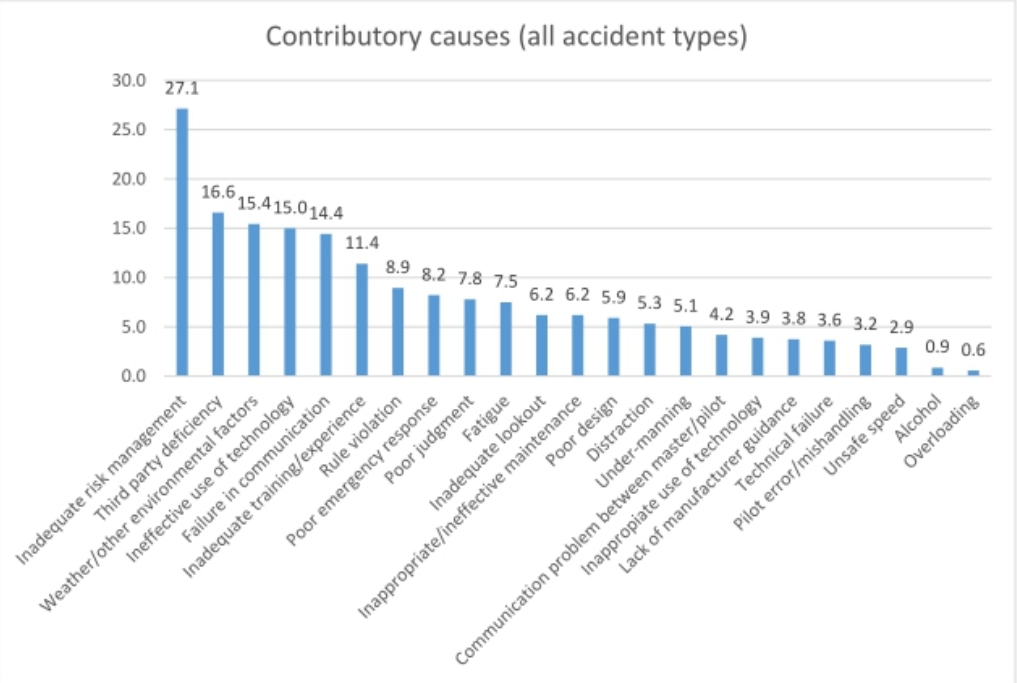

Figure4: The main causes of maritime accidents
(source:Acejo et al., 2018)

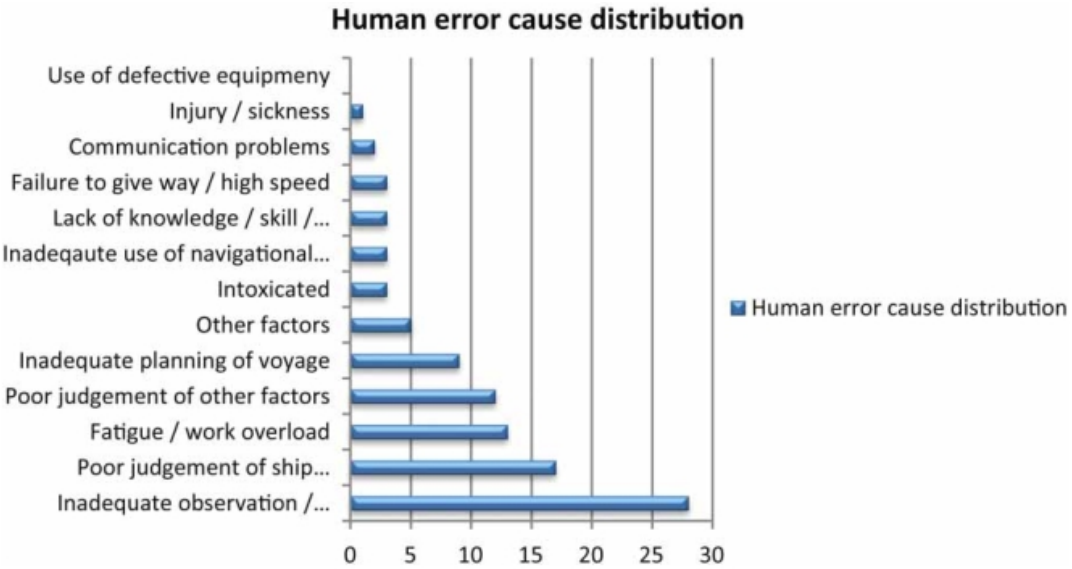

Figure5: Human error cause distribution in maritime accidents
(source: Cheng, D., 2020)

2.3 Practice of sample coutries

2.3.1 The Philippines

Over the past several decades, the Philippines has remained one of the world's leading suppliers of seafarers (BIMCO & ICS, 2015; Gali, S. et al., 2012).The training mode of seafarers in the Philippines mostly adopts the mode of school-enterprise cooperation and order training. Take The Asia Pacific Maritime College as an example. The college is an undergraduate institution with a four-year length of schooling, in which students are arranged to board the ship for on-board exercise in the third academic year. The college mainly offers two majors: Marine navigation and Marine engineering. In addition, according to the requirements of customers, the college also offers the combined Marine Driving and Marine Engineering (CMSA, 2010).Before on-board exercise in their third academic year, some students will go to the college's training ship for on board exercise, while the rest may choose the college's partners to deal with this issue. After graduation, students will sign a service contract with the ordering company for 5 years, and then sign a later service contract based on two-way selection after the completion of service. The National law of the Philippines also requires students to obtain a bachelor's degree before taking the officer level Seafarers' competence assessment (Bao et al., 2010).

2.3.2 Singapore

Maritime education in Singapore focuses on vocational education and focuses on cultivating students' practical operation ability. The “sandwich training mode” of School-enterprise cooperation is commonly adopted (Bao et al., 2010).Diploma in Nautical Studies (DNS) is a three-year course of study in three stages, including a year of on board training. In the first year, students are given basic pre-ship training and a brief introduction to their expertise. In the second year, all trainees are required to undertake a 12 month on board training at sea, which is subject to the requirements of the MSA. During the on board training period, in addition to

completing the exercise tasks assigned by the company director or the ship captain, in order to ensure the quality of the on board training, the Navigation College and the MSA training department jointly compile the on board training report. Each student should complete all the on board training tasks before getting off the ship in order to participate in the maritime competence assessment carried out by MSA. The third stage is the one-year professional theory strengthening stage, which not only increases the number of professional courses, but also has a certain depth. In this stage, instructors of the nautical college will also combine their own experience in the ship with students who have practiced in the ship to carry out an extended discussion. Upon completion of the 3-year study at The Singapore Maritime Academy, students are eligible to take the competence assessment for the level-3 COC (Second Officer, Second Engineer) as long as they have met the 12 months maritime age during the second phase of the maritime on board training and passed the written test according to the requirements of the MSA. In addition to the written part of the exam, which is based on the graduation exam results of the College of Navigation, the Singapore MSA also requires candidates to pass a simulator and oral test attended by the assessors in charge of the examination department (Zhao et al., 2009).

2.3.3 United Kingdom

In the UK, merchant navy training board (hereinafter referred to as MNTB) is responsible for establishing the maritime education and training system for merchant ships and recognizing relevant maritime education and training projects of some colleges and universities (Lv & Wen, 2012). Upon completion of the required education and training courses for navigators, engineers and electronics technicians, students are awarded a degree (undergraduate honours degree and/or FD/SPD), HNC and/or HND or professional qualifications. All courses are alternating between

college/university on campus study and on board training. Upon completion of the studies, the candidates may apply for the MCA examination and obtain the statutory duty officer (OOW) or duty engineer (EOOW) Certificate of Competency (COC).

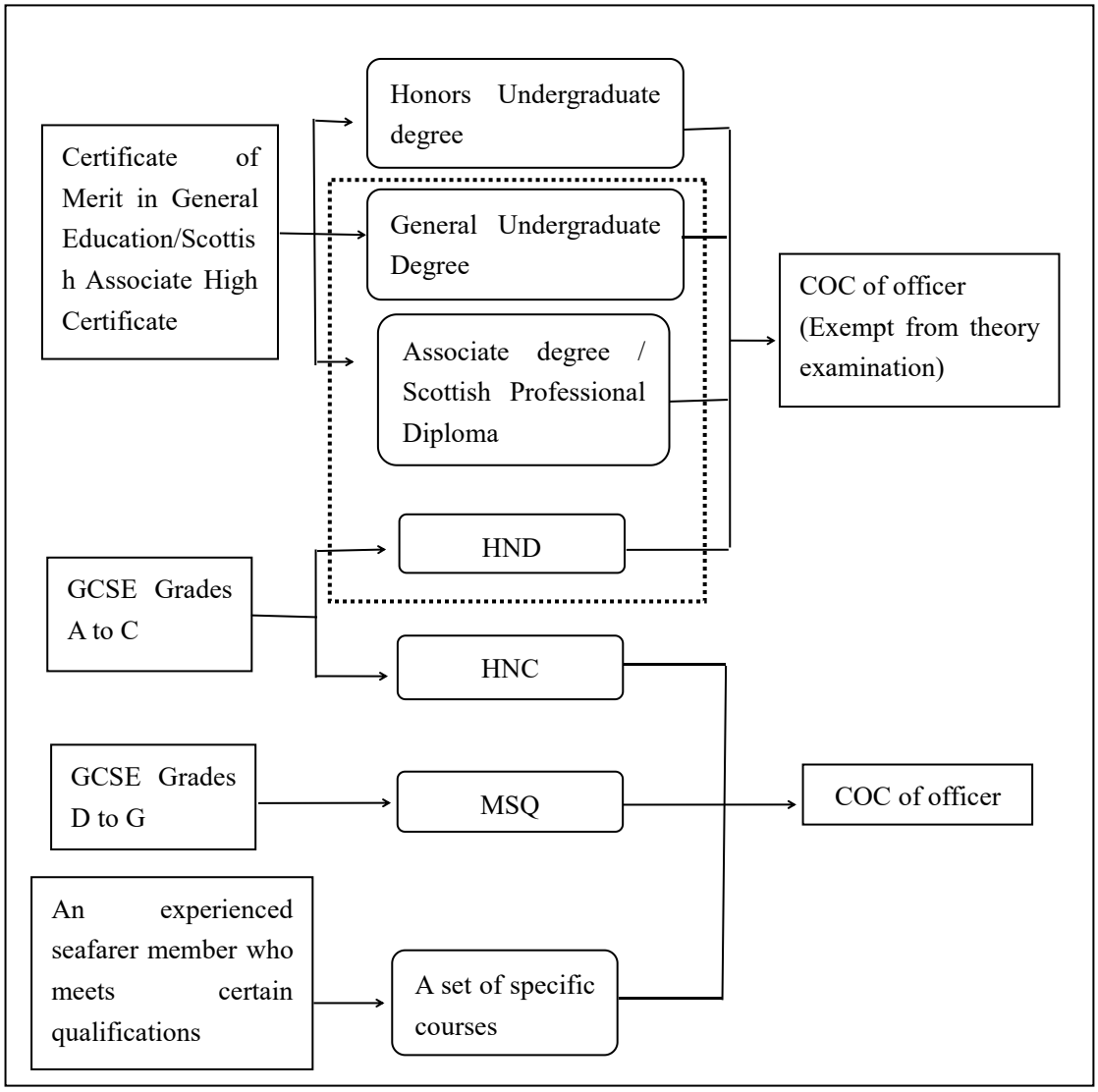

Figure6:British Maritime education system and schematic diagram of application for Certificate of Competency
(source:LV & Wen, 2012)

2.4 Summary

STCW convention as amended rules the issues concerning the training certification

and watchkeeping of seafarers globally. The STCW code lists the minimum standards of seafarers competence. It has played a positive role in establishing and promoting the common standard of competent seafarer all over the world. However, the STCW Convention as amended does not provide specific provisions on the methods of seafarers' competence assessment, and the specific methods are determined by each member state itself, which also leads to the fact that the certification of seafarers' competence is not completely unified around the world, and there are some differences in the standards of seafarers' competence recognition among various countries.

Despite the great improvement in maritime safety thanks to the joint efforts of IMO and its member states, seafarers are still one of the most dangerous occupations all over the world. Seafarers' skill level and comprehensive quality play an extremely important role in maritime safety at sea. Human factors have been the main cause of maritime accidents for a long time, and seafarers' safety awareness and competence are still the main inducing factors of maritime accidents.

Based on the comparative analysis of the practices of the Philippines, Singapore and the United Kingdom on seafarer training and assessment, the practices of each country are different, and the models of seafarer training and the methods of competence assessment have their own characteristics. The Philippines is now the world's largest supplier of management-level seafarers, and its seafarers are generally well received and well regarded around the world. In the course of their seafarers' training, the school and enterprise work closely together, and a special on board training session has been set up. Singapore has a relatively complete training and education system for seafarers, and attaches great importance to practical training in the training and assessment process of seafarers, and attaches great importance to the

recognition of results of seafarers' competence assessment by METs. The united kingdom is a developed country as well as a traditional maritime power. However, the number of people engaged in seafarers is relatively small at present, and its maritime education lays particular stress on the education of diplomas. These three countries represented by different types of maritime education model have a certain reference significance.

CHAPTER 3 THE SEAFARERS' COMPETENCE ASSESSMENT IN CHINA

3.1 Chinese seafarers' competence assessment

3.1.1 The framework of legislation and regulation

China is an original signatory and state party to the STCW78 Convention. After acceding to the STCW Convention, China revised and issued the Measures of the People's Republic of China for the Examination and Certification of seafarer of Ships (" 1979 Measures ") and the Rules of the People's Republic of China for the Examination and Certification of seafarer (" 1987 Rules "). With the modification convention, China successively issued the "Rule of the People's Republic of China on seafarer competence examination, assessment and certification" (hereinafter referred to as the "97 rule"), the "Rule of the People's Republic of China on seafarers' competence examination, assessment and certification" (hereinafter referred to as the "04 rule") and the "Rule of the People's Republic of China on seafarer competence examination and certification rules (the "rules of 11" and "rules") (CMSA, 2019).

At present, the Ministry of Transport (MOT) is in charge of seafarers' competence assessment in China. Under the leadership of the MOT, the Maritime Safety Administration of China (CMSA) uniformly manages seafarers' competence assessment, and is responsible for the qualification approval, supervision and administration of METs (CMSA, 2014). The 14 maritime safety administrations directly under the CMSA are responsible for the implementation, supervision and administration of seafarers' assessment within their respective jurisdictions as well as the daily supervision of seafarers' training process and the issuance of seafarers' COC as authorized. The assessment of seafarers' competence is carried out in accordance with the methods and contents stipulated in the STCW Convention as amended and

the training syllabus of seafarers' competence formulated in China, in the form of theoretical test and practical operation assessment. The theory test is composed of multiple choice questions, which are answered by the candidates on the computer. The computer system also calculates the scores of the candidate immediately after the completion of the test. The operational assessment is carried out by means of simulator operation, laboratory operation, computer and oral question and answer. In recent years, CMSA has been intensifying its efforts in the research and development of intelligent test questions and scenarios. At present, seafarers' competence assessment can be scored by computer system, and the whole process of competence assessment is paperless.

Duties of seafarers fall into two categories: those who participate in watchkeeping and those who do not participate in watchkeeping. Duties of seafarers who participate in watchkeeping include (MOT, 2020):

1. Master；

2. Deck department： chief officer, second officer, third officer, able seafarer deck, ratings forming part of a navigation watch;

3．Engine department：Chief engineer, second engineer, third engineer, fourth engineer, electro-technical officer, electro-technical rating, able seafarer engine,rating forming part of a engineering watch；

4. Radiocommunication and radio operators：Level 1radio electronics Officer, level 2 radio electronics officer, General radio operator, limited radio operator.

According to the technical requirements, seafarers are divided into three categories: management level, operational level and support level.

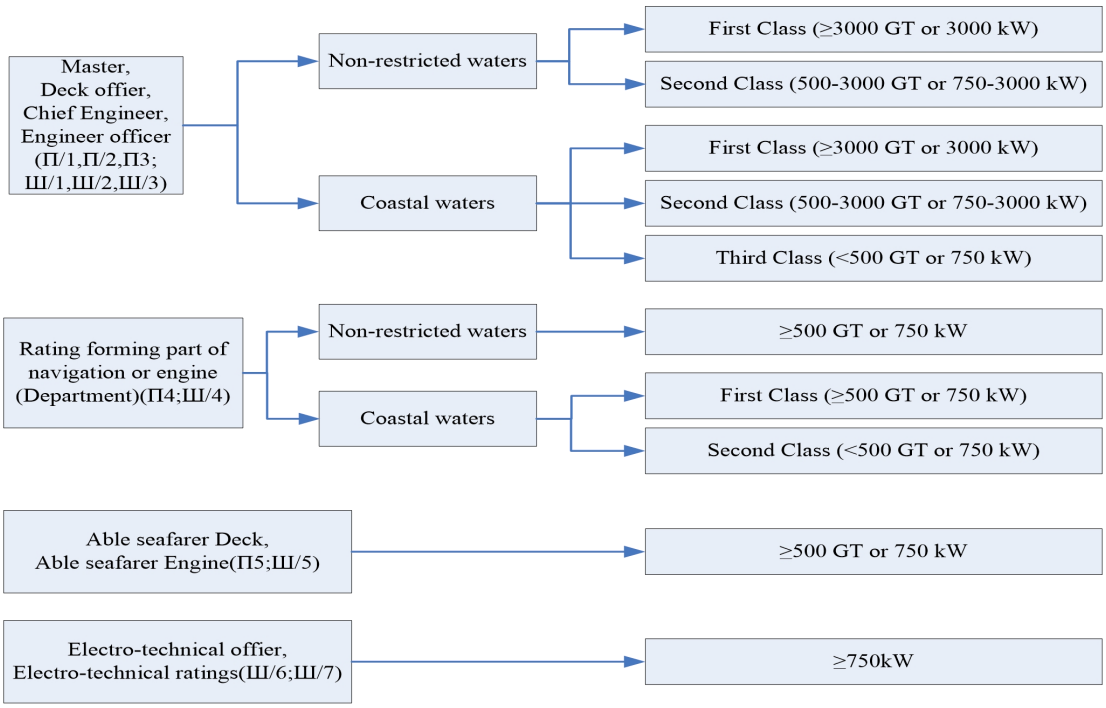

Figure 7: Category of Certificates for Chinese Seafarers
(source：BAO, 2020)

The basic training mode for seafarers is to participate in the training courses corresponding to the applying COC carried out by qualified METs. After all the training programs have been completed, he/she shall attend competence assessment which contains theoretical test and practical operation assessment organized by the MSA. Once the candidate pass the assessment, he/she can complete the on-board training for a certain period of time. Or the candidate can attend the on-board training after he/she passed the theoretical test, and participate the practical operation assessment after the on board training. Then, the candidate may apply for the seafarer's COC for the corresponding position. The assessment of seafarers' competence will be entirely carried out and verified by the MSA. METs are only

responsible for carrying out training in accordance with the prescribed content and the requirements of the class hours. On board training shall be conducted by candidates themselves on ships of shipping companies or on specialized training ships of METs (see Figure 8).

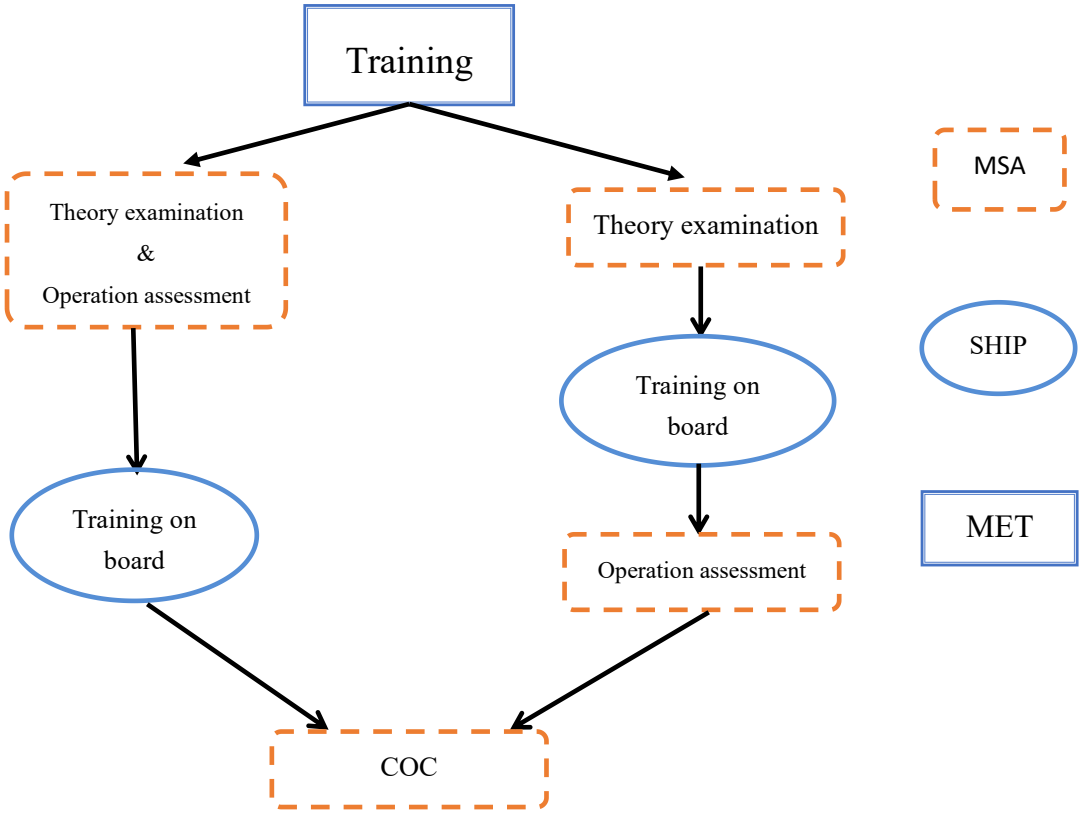

Figure8：The training methodss of seafarers in China
(Source: author, complied by CMSA)

In 2006, the Ministry of Transport issued the "Training Outline for Seafarers' Competency", and the content of seafarers' competence assessment is determined according to the outline (see Figure 9). According to the regulations on the implementation of the measures for the seafarers' competence assessment issued by the CMSA, seafarers' competence assessment will be divided into specific subjects and items. Take the applicant of more than 3000 gross tonnage international voyage

second/third officer COC as an example, the applicant needs to take the theory test subjects including maritime navigation, ship maneuvering and collision avoidance, ship management, ship structure and shipping, maritime English, needs to participate in the practical operation assessment program including ECDIS, voyage design, operation and application of radar, ship maneuvering, collision avoidance and bridge resource management, cargo stowage and securing, maritime English listening and speaking (see table 2 and table 3) (CMSA, 2012).

Table2:The model of the training outline of seafarers in China

Requirements of competence		Theoretical knowledge and requirements	Practical skill and requirements	Evaluation standards	Class hours	
					The ory	pra ctic e
Function: navigation (management level)						
1.4 Establis h watchke eping arrange ments and procedur es	A comprehensive knowledge of the content, application and intent of the revised COLERGE A comprehensive knowledge of the content, application and intent of the basic rules should be obeyed in navigation	.1 Master COLEREG (22 h) .2 Master the rules of navigation (12h) .3 Master the standards of prevention of alcohol abuse and control of drugs(2h) .4 Master of the reasons of fatigue to seafarers and the preventing ways(2h) .5 Master the effect, aim, equip requirements, alarm, and working ways of BNWAS(2h)	Training in laboratory: .1 can establish effective watchkeeping arrangements as per MLC and STCW (5h) .2 familiar with the operation of BNWAS(1h)	Establish and maintain watchkeeping arrangements and procedures, so as to protect the marine environment and safety of ship and people onboard	46	6

source:MOT, 2016

Table3: The theory test subjects of master, deck officer

(Source: author, complied by CMSA)

OCCUPATION / Type of test / Subjects	master			Chief officer			Third officer		
	promotion	Area to expand	Tonnage raise	promotion	Area to expand	Tonnage raise	promotion	Area to expand	Tonnage raise
Maritime navigation	☆	☆	★	☆	☆	★	☆	☆	★
Ship maneuvering and collision avoidance	☆		★☆	☆		★☆	☆		★☆
Ship management	☆	☆	★	☆	☆	★	☆	☆	★
Ship construction and shipping			★☆	☆		★☆	☆		★☆
Maritime English	☆	☆		☆	☆		☆	☆	

Notes: 1. The subjects marked "☆" in the table are the corresponding positions and application forms of seafarers with a gross tonnage of 500 and above.

2.The test subjects marked "★" in the table are those subjects that should apply for the corresponding examination form when applying for the corresponding post of seafarers under 500 GROSS tons .

Table4：The items for operational assessment of master, deck officers
(Source: author, complied by CMSA)

Occupation / Type of assessment / Items	Master			Chief officer			Third officer		
	promotion	Area to expand	Tonnage raise	promotion	Area to expand	Tonnage raise	promotion	Area to expand	Tonnage raise
Voyage plan	☆★	☆							
Analysis of meteorological facsimile charts	☆	☆							
ECDIS				☆	☆		☆	☆	

Voyage design							☆★	☆	
Radar operations and applications							☆★		
Ship manoeuvring, collision avoidance and bridge resource management	☆★		☆	☆★		☆	☆★		☆
Stowage and securing of cargo				☆★	☆	☆	☆		☆
The use of navigational instruments							☆★		
Listening and speaking of maritime English	☆	☆		☆	☆		☆	☆	

Note: 1. The assessment items for applying for the second officer are the same as those for applying for the third officer COC.

2. The items marked "☆" in the table are the assessment items corresponding to the position and application form of seafarers with a gross tonnage of 500 tons or above.

3. The evaluation items marked "★" in the table are the corresponding positions and application forms of seafarers with less than 500 GROSS tons.

Table5：The items for operational assessment of engine officers
(source: author, complied by CMSA)

OCCUPATION / ASSESSMENT TYPE / ITEMS	Chief engineer			Second engineer			Fourth engineer		
	promotion	Area to expand	Power raise	promotion	Area to expand	Power raise	promotion	Area to expand	Power raise
Engine room simulator	☆		☆						
Power plant test analysis and operation			☆	☆		☆			
Power equipment disassembly and installation			☆	☆★		☆	☆★		☆

Electrical and automatic control			☆	☆		☆	☆★		☆
Power plant operation							☆★		☆
Ship electrical technology and electrical equipment			☆			☆	☆		☆
Metalworking technology			☆			☆	☆		☆
Engine-room resource management	☆		☆	☆		☆	☆		☆
Listening and speaking of Marine Engineering English	☆	☆		☆	☆		☆	☆	

Note: 1. The evaluation items for applying for the second pipe roller are the same as those for applying for the third pipe roller competency certificate.

2. The items marked "☆" in the table are the assessment items corresponding to the position and application form of seafarers with a gross tonnage of 500 tons or above.

3. The evaluation items marked "★" in the table are the corresponding positions and application forms of seafarers with less than 500 GROSS tons.

3.1.2 The methodologies of seafarers' competence assessment in China

China's provisions on seafarers' competence standards are similar to those in the STCW Convention as amended, with more specific duties and grades, which increase the competence requirements for seafarers serving only ships sailing in China's coastal navigation areas. Currently, China does not have a separate assessment syllabus for seagoing seafarers, only that the content of the competence assessment for seagoing seafarers is determined in accordance with the training outline. The rules of assessment and certificate of seafarers only stipulates the theoretical subjects and operational items of seafarer's competence assessment, but does not stipulate the methods and procedures of seafarer's competence assessment. The seafarer's competence assessment is carried out according to the separate theoretical subjects and modules of practical operation items. Because the assessment of seafarers'

competence is carried out by 14 maritime administrations directly under the CMSA in different regions. On the premise of ensuring the national unification of the assessment subjects and items, the CMSA will guarantee the national unification of the specific assessment methods, procedures and evaluation standards for individual operational items through meetings, notices and the deployment of unified special computer software for the assessment of seafarers throughout the country. Meanwhile, the CMSA is responsible for the qualification evaluation and approval of METs national wide, so as to ensure that the training equipment, teaching curriculum and teaching methods equipped by METs nationwide to carry out maritime education and training business can meet the same standards and performance requirements. The maritime safety administrations directly affiliated to the CMSA carry out the assessment of seafarers' competence by means of the sites and equipment of seafarers' METs, which ensures the consistency of the methods and procedures of seafarers' competence assessment nationwide to a certain extent. Nevertheless, due to subjective and objective reasons such as the recognition and understanding of authorities in different regions and the number and ability of assessors in their respective jurisdictions, there will be some differences in the methods, operating procedures and evaluation standards of seafarers competence assessment in the actual operation process of different administrative departments.

The practical operation assessment methods of seafarers' competence assessment widely adopted in China can be divided into:

1. Environment simulation operation on simulators;
2. Analyze and answer questions of a given case (paper + oral);
3. Computer;
4. Operation of laboratory equipment;
5. Physical manipulation or demonstration.

Among the items listed in table 5 and table 6 deck and engine departments, all officer level seafarer competence assessment, ship maneuvering, collision avoidance and bridge resource management and engine room resource management are carried out with the help of a bridge or engine room simulator. Voyage design, voyage plan and cargo stowage and securing, the examinee shall, according to the set of navigation task to carry on the design or written answer. The English listening and speaking item is scored by the assessor after the examinee and the developed test software choose and answer the objective questions and record the man-machine conversation. All other items will be carried out by marine equipment installed in the laboratory. In the assessment items carried out with the aid of the simulator, 3 to 4 examinees form a group, each acting as a functional seafarer, complete their respective tasks according to the set scenario, and then rate them respectively. Other equipment operation items will be operated by examinees according to the given task and scored according to the operation situation. In addition to the English listening and speaking assessment, one or more assessors will be responsible for scoring the performance of each test candidate of the specific item, and the final decision will be made by the examiners in charge of the MSA. The scenarios and task setting of the examinee assessment are made by the MSA according to the competence requirements and practical skills requirements stipulated in the training outline, and then the question bank is made and extracted from it.

Table6: The methodologies of each practical operation assessment item

Methodologies	Practical items
Simulator	Ship maneuvering, collision avoidance and BRM, ERM
Question and Answer for a Given case (paper & oral)	Voyage design, Voyage planning, Cargo stowage and securing (chief officer)

Computer answer & manual evaluation	Maritime English listening and speaking, Weather Facsimile and analysis (Master), Cargo stowage and securing（second/ third officer）
Laboratory equipment operation	ECIDS, Radar operation and application, Operation of navigation devices, Power plant test analysis and operation, Electrical and automatic control, Power equipment disassembly and installation, Ship electrical technology and electrical equipment
Physical manipulation or demonstration	Metalworking, Lifeboat and rescue boat operation, Fire fighting, Others

Source: author

3.1.3 The data of seafarer competence assessment in China

By the end of 2019, China had a total of 784,355 registered seafarers (MOT, 2020). In 2019, a total of 182,962 person×time across the country participate seafarers' competence assessment. At the same time, the enrollment of all kinds of METs is still on the rise.

Table 7：The total participates of seafarers' competence assessment 2017-2019

(unit: person×time)

Year	2017	2018	2019
Candidate	90929	133,526	182,962

source： Author , complied by MOT 2018, 2019,2020

Table 8: The enrollment of maritime major in China

(Unit: person)

Major	Number of enrollments				
	2015	2016	2017	2018	2019
Navigation	8193	8229	6844	9248	10536
Engineer	6767	7106	5959	7750	8328
Electronic electrical	—	1041	997	1385	1561
Total	14960	15335	12803	16998	18864

(source： MOT， 2020)

The number of candidates taking the seafarers' competence assessment is large, but the number of candidates passing all the theoretical subjects and practical items at once is small. In 2019, 50,875 candidates passed the competence assessment organized by the MSA across the country (MOT, 2020), which held about 28% of the total number of candidates participating in the competence assessment. By comparing the one-time pass rate of candidates applying for the COC for seafarers of international navigation ships of 3000 GROSS tonnage /KW or above in the recent three years, it is found that the pass rate of applicants for seafarers of different ranks is also different. The higher the position, the higher the pass rate.

Table9: The one time pass rate of above 3,000 GT/KW international voyage COC

Year	2017	2018	2019
Master	68.60%	71.70%	70.70%
Chief officer	57%	60.60%	59.90%
Second officer	70.30%	61.30%	72.40%
Third officer	27.30%	25.40%	23.80%
Chief engineer	68.10%	78.90%	79.60%
Second engineer	52.40%	57.00%	57.50%
Third engineer	92.70%	84.90%	82.60%
Fourth engineer	22.10%	21.20%	23.30%

Source: (Author , complied by MOT 2018, 2019,2020)

3.2 Evaluations of the seafarer's competence level in China

According to a study commissioned by the CMSA and conducted by the Wuhan Maritime Shipping Exchange (WSE), graduates majoring in navigation must pass the seafarer competence assessment, but the content and format of the assessment are difficult to measure the overall quality and practical ability of graduates. Even seafarers who have obtained the COC through the competence assessment organized by the competent maritime authorities have a significant gap between their post competency and the requirements of shipping enterprises (He & Ren, 2018). The current quality of Chinese seafarers cannot fully meet the safety and development needs of the shipping industry. The seafarers have a narrow range of knowledge, lack knowledge of economy, management and law, etc., and have weak awareness of life and environmental safety protection, low level of foreign languages, and weak sense of discipline and obedience (Yao et al., 2018). Only Chinese seafarers are allowed to work on Chinese flagged ships. According to the annual report on maritime accidents investigation issued by CMSA, the main cause of maritime traffic accidents on Chinese flagged ships in recent years is always related to human factors (CMSA, 2018 / 2017/ 2016). Seafarers' sense of responsibility is not high, and they are prone to paralysis and luck, and accidents often occur for negligence, mistakes or non-compliance with rules. Some captains do not obey the command of traffic control and take risks in sailing beyond the limit of the certificate. Some crew members have insufficient judgment ability of danger and safety awareness of self-protection and weak practical skills in emergency situations (CMSA, 2017).

3.3 The international competitiveness of Chinese seafarers

China is one of the main seafarers suppliers in the world. According to the report on the development of Chinese seafarers 2019, a total of 155,449 Chinese seafarers were sent abroad in 2019, accounting for less than 20 percent of the total number of

Chinese seafarers. However, as shown in figure 9, the seafarers dispatched are mainly ordinary crew members, most of whom ratings, waiters or other labor personnel, rather than officers on board and crew members responsible for ship navigation watch and management (CMSA, 2020). In addition, most of the ships served by Chinese seafarers on foreign ships are owned by Chinese companies (Wu & Winchester, 2005). According to a study published by Wang & YEO in 2016, after a comprehensive comparison and analysis of seafarers from China, the Philippines, Indonesia, Vietnam and Myanmar, it is found that Chinese seafarers' overall competitiveness ranks the last among the five countries, and an important reason is Chinese seafarers' poor English communication skills (Wang & YEO, 2016). Although each seafarer holding a Chinese-issued COC has passed the theoretical English test and the English listening and speaking item in the assessment of competence.

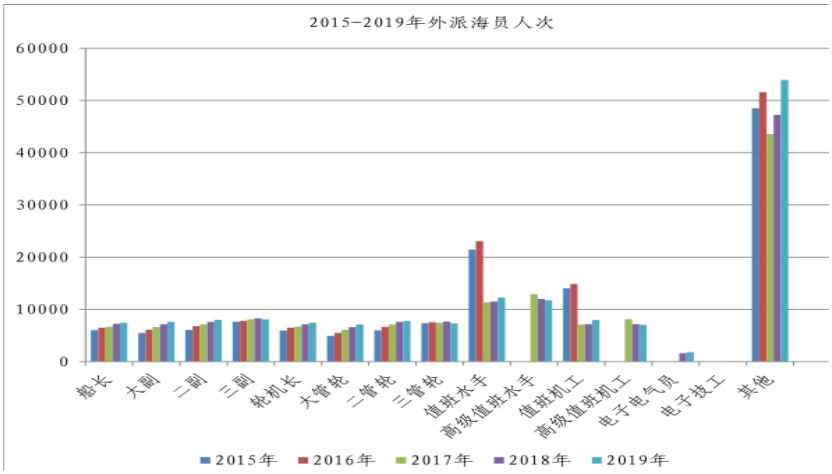

Figure9: The number of seafarers dispatch abroad
(source: MOT, 2020)

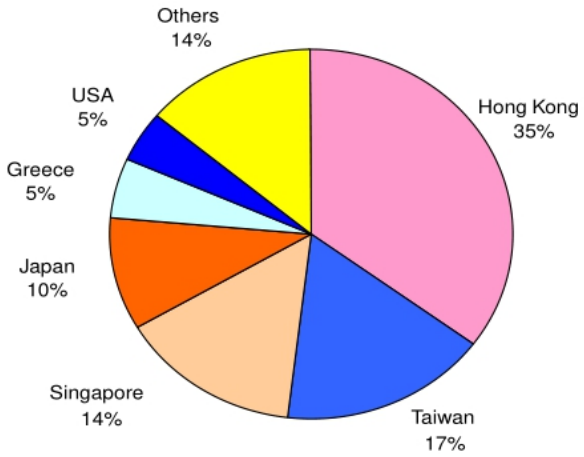

Figure10: Chinese seafarers on board fleets registered out of the main land of China
（Source: Wu & Winchester, 2005）

CHAPTER 4 ANALYSIS OF SEAFARERS' COMPETENCE ASSESSMENT METHOD IN CHINA

4.1 Questionnaire review

Through questionnaire (see Appendix 1 for the questionnaire style) on different object groups of seafarers, maritime administrative agencies, METs and seafarers' employing units, the author tries to find out the evaluation of the applicable methods for the assessment of seafarers' competence by different units and individuals involved in seafarers' occupation. After months of efforts, a total of 174 valid questionnaires were collected, among which 76 were from Chinese seafarers, 26 from teachers or managers of METs, 34 from students majoring in navigation, 2 from shipping companies/seafarers' service agency, and 36 from staff of MSA. The professional distribution of the sources is relatively comprehensive. The sources of the questionnaire are widely distributed in 8 provinces, including Guangdong, Liaoning, Shandong and Jiangsu. The questionnaire has certain representativeness.

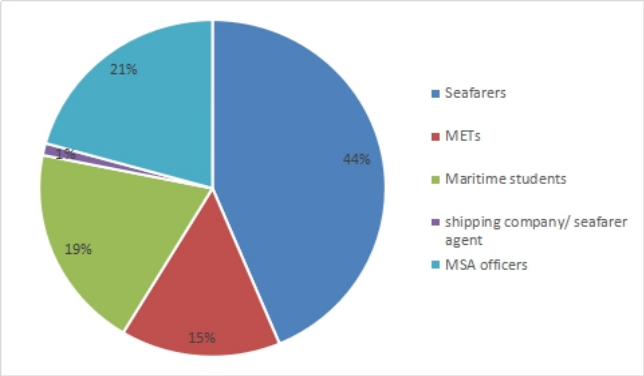

Chart 1 : The professional sources of questionnaires (source: author)

Through the questionnaire, although most respondents believe that China's current practices meet the relevant requirements of the STCW convention as amended, most of them hold reservations about the methods, implementation procedures and standards adopted for the assessment of the competence of seafarers in China. As for

the role of the current seafarers' competence assessment in improving seafarers' skills and ensuring traffic safety at sea, more respondents also think that there still exists room for improvement.

In terms of meeting the requirements of the convention, more than three-quarters of respondents believe that China's current methods of assessing seafarers' competence meet the requirements of the relevant conventions.

Items	percentage of response (n=174)		
	Good	Acceptable	Bad
Conformity to STCW contention	77.59%	14.94%	7.47%

At the same time, only 26.44% think that the theoretical examination and practical operation assessment content distribution of the current Chinese maritime ship seafarer competence assessment is completely reasonable, and 18.97% think that it is completely unreasonable.

Items	percentage of response (n=174)		
	Good	Acceptable	Bad
The distribution of theory and practical operation in present seafarers' competence assessment in China	26.44%	54.6%	18.97%

Less than 36% of the respondents believe that the seafarers' actual ability can be truly reflected by the seafarers' competence assessment methods currently used in China.

Items	percentage of response (n=174)		
	Good	Acceptable	Bad
Whether the current Chinese seafarers' competency assessment method can truly reflect the seafarers' real ability	35.63%	52.87%	11.49%

Less than 31% of the respondents think that the specific evaluation methods and

evaluation criteria adopted are reasonable.

Items	percentage of response (n=174)		
	Good	Acceptable	Bad
Rationality of the methodologies adopted and the criteria for assessment	30.46%	54.6%	14.94%

In terms of ensuring maritime traffic safety and promoting the long-term development of seafarers, half of the respondents believe that China's current seafarers' competence assessment method can guarantee maritime traffic safety. Nearly 64 per cent of respondents believed that the current method to assessing seafarers' competence was beneficial to the development of the seafarers' workforce.

Items	percentage of response (n=174)		
	Good	Acceptable	Bad
Promotion to maritime safety	50%	40.8%	9.2%
Benefit to the future seafarer market	63.79%	22.99%	13.22%

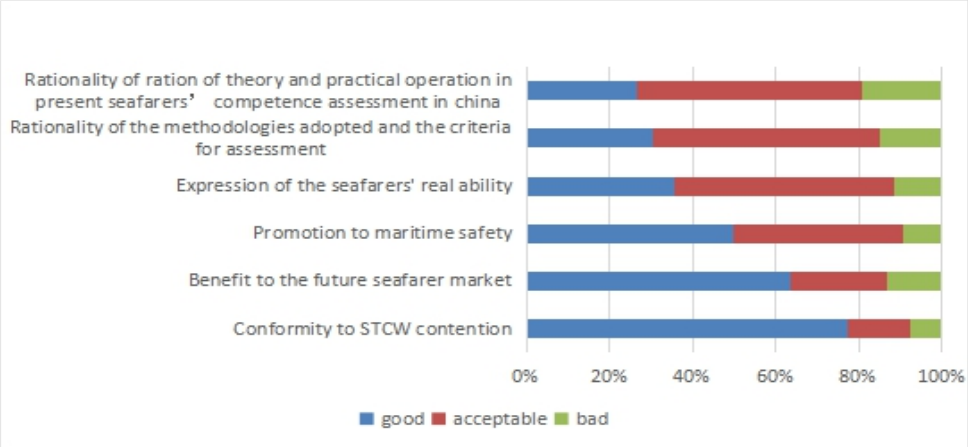

Chart 2: The opinion on the method of seafarers' assessment in China (source: author)

In the open evaluation survey of the current assessment methods for the competence of Chinese seafarers, many respondents believe that the practical operation assessment should be carried out in a way closer to the actual environment, focusing on examining the practical operational ability of the candidate, and reducing the

proportion of theoretical examination. There are also many respondents who believe that China should adjust the current model of seafarers' competence training and assessment and gradually develop towards diversified approaches such as "sandwich model" (institutional training + shipboard training + institutional training, and then conduct competence assessment).

4.2 Analysis of "four natures"

The seafarer's competency assessment is different from the general national education system. It is an occupational competency system, which is an entry point for specific jobs in specific industries.

Table 10 Comparision between normal national education system and occupational competence system

Content	Normal national education	Occupational competence
Goal of training	Impart knowledge	Develop skills for specific job
The evidence and methods of assessment	Course assignment and examination	Practical work ability, with aid of oral instruction, writing, etc.
Rules of assessment	Once after the course finished	Continuous process
Goal of assessment	Obtain the knowledge	Competent for duties

Source: Lin, 2010

In general, there are four criteria to judge whether a kind of assessment is scientific, namely, reliability, validity, difficulty and discrimination (Qie, 2012). this can also be applied for evaluating the method of seafarers' competence assessment in China.

.1 Reliability

Reliability is the degree of reliability of the assessment process and reliability of assessment results. With high reliability, the assessment results are not affected by the assessment time, invigilators, venue and other factors, and have good consistency and stability.

In the current Chinese seafarers' competence assessment, the theoretical examination part is organized by China Maritime Service Center (CMSC). CMSC establishes a unified question bank through organizing national maritime education and maritime field experts, and then the examination is conducted through a unified national computer software. The question bank will be updated and audited periodically every year, so it also has high reliability. The practical operation assessment part shall be organized and carried out by the 14 maritime administrations directly under the CMSA deployed in China.

The assessment items and overall contents shall be determined in accordance with the regulations issued by CMSA. During the process of the assessment of the items other than carried out by means of “Computer answer & manual evaluation” listed in table 5, the specific ways of assessment and the practical content will be decided and assigned by the examiner and assessors, the evaluation criteria are also largely affected by the assessors’ professional judgment and personal impression. Especially in the area and time where the seafarers’ assessment is large scale and concentrated, there will be some uncertainty in the reliability of the competency assessment if the assessment is carried out by an assessor alone.

.2 Validity

Validity refers to the degree to which a test can measure something intended to be measured. It is the quality index of test validity or correctness, and the level of test validity reflects the degree to which the test achieves the expected purpose. According to the questionnaire,it is found that about one-third of the respondents believe that the current Chinese seafarers competence assessment method can fully reflect the actual capacity of competence of the assessed, half of them think it can reflect some practical competency ability but not full, about one in ten of the people think that it could not reflect the assessed actual competence ability. Many domestic scholars or institutions have also found that the assessment of Chinese seafarers' competence is to some extent divorced from reality and the proportion of theory is too high. Training and education is developed on the basis of examination. Assessment cannot reflect the operational ability of the assessed in the actual situation and environment (Chen, 2006; Xin, 2010; Wang et al., 2020). Chinese seafarers generally have difficulties in English listening and speaking, which also indicates that the assessment of English item cannot truly reflect the ability of Chinese seafarers to use English. Even if they pass the assessment of English item and obtain the COC, many seafarers still have difficulties in communicating with seafarers from other countries when working on the ship (Li, 2019). According to LI Yan's research in 2019, Chinese seafarers keep a negative attitude towards the accuracy of English competency assessment methods in assessing their actual English communication ability.

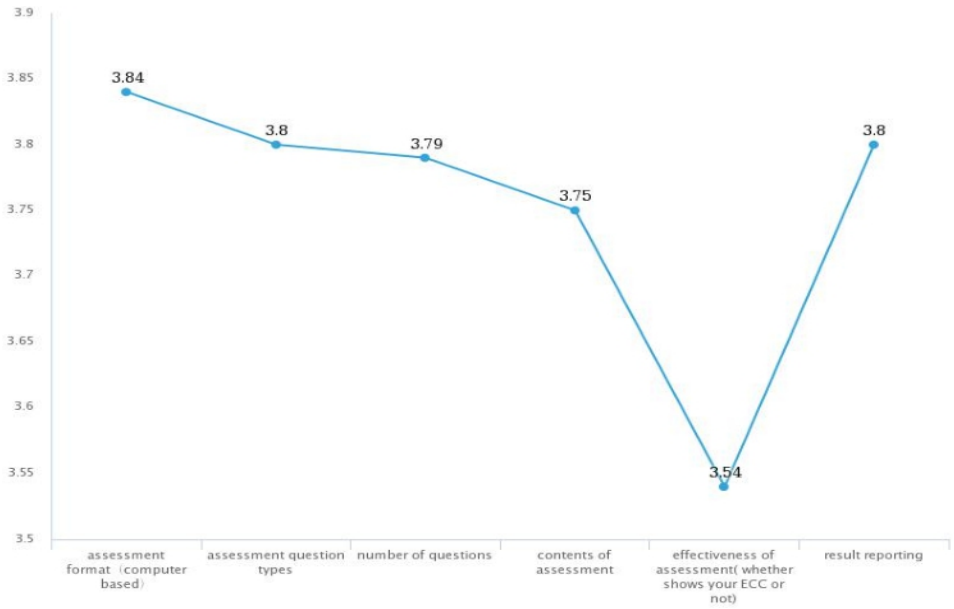

Figure 11： Chinese seafarers' view over the ME assessment
（source: Li, 2019）

In general, there is still a big gap between China's current assessment of seafarers' competence and true and accurate reflection of the actual working ability of the candidate，the validity of the assessment is not enough.

.3 Difficulty

Difficulty refers to the difficulty of the examination questions. It is usually calculated by the coefficient of difficulty. Generally, the difficulty coefficient is calculated with the letter P, P= average score/full score value, the larger P means the easier the test, and the smaller P means the more difficult the test. It is generally believed that the difficulty coefficient of the examination questions is more appropriate between 0.3 and 0.7. According to Table 9, from 2017 to 2019, the one-time pass rate for the assessment of seafarer competence of the third officer and the fourth engineer is less than 30%. The third officer and the fourth engineer are the entry level for officer level seafarers, and usually students from colleges and universities majoring in navigation and engineering take part after completing the pre-post training. The

passing rate is less than 30%, which also reflects the difficulty of seafarers' competence assessment for such groups is to some extent high.

.4 Discrimination

The degree of discrimination refers to the degree of differentiation or the ability to distinguish the actual level of examinee. It is an important index to measure the quality of test and examination questions. The exam with high discrimination degree, can divide outstanding, general, poor level of examinee apart, the examinee of each fractional paragraph has certain proportion. Seafarer's competence assessment is a occupational qualification examination, which can only be divided into qualified and unqualified, and seafarer's performance is no longer graded. This guarantee the fairness of the seafarers' career access, but also lose the a reference basis for the development of seafarer competition. The employer can not compare the competence level of seafarers only based on the COC when choosing employment or promotion, thus leading to seafarers competency assessment lack of incentive indeed.

To sum up, China's current seafarers' competence assessment method plays a certain role in guaranteeing the reliability of seafarers' competence assessment, but it needs to be further strengthened in practical operation assessment. In terms of validity, the current assessment methods of seafarers' competence can not fully and accurately reflect the true ability level of seafarers. At the same time, the difficulty is too high (especially the theory examination), and the discrimination is not enough, which limits the incentive effect of seafarer's competence assessment on seafarers to some extent.

CHAPTER 5 THE APPLICATION OF NEW TECHNOLOGY AND RESEARCHES IN SEAFARERS' COMPETENCE ASSESSMENT

5.1 Contextual simulation

STCW convention as amended specified simulator for use in seafarers training competence assessment. STCW code A - I / 12 expounds using simulators for training is in order to be able to more close to the actual working tasks and environment on board, and requires the use of simulator for training and assessment should be able to guarantee the simulator performance standards can meet the target requirements stipulated in the convention. The use of simulators for competence assessment should ensure that assessment criteria are clear, ensure the reliability and consistency of assessment, optimize objective assessment measures, and reduce and maintain subjective judgments to a minimum level.

Without rigorous assessment, the expected training effect would be difficult to achieve (Raymond & Usherwood, 2013). Assessments of seafarers should be more contextualized to reflect what they can achieve in the workplace through training. The use of virtual reality technology and simulation equipment can be closer to the real environment and actual work tasks, which is conducive to more real and accurate response to the actual response and operation ability of the candidate. Simulators can help evaluate the task performance of the candidate under different scenarios and conditions (Maung, 2019). Many candidates say that using simulators is more difficult than writing exams because they cannot erase mistakes and do them over again. The candidates will benefit more by using the simulator for assessment, because they need to learn to react quickly, make correct decisions and reduce mistakes (Maung, 2019). With the continuous development of simulators, computer

data processing and VR and AR technologies, more possibilities will be provided for the construction of a more realistic working environment on board ships and the faster and more efficient assessment of the actual competence of applicants for COC.

5.2 Authentic assessment

Authenticity refers to combining with the actual situation and paying more attention to the actual operation performance. Authentic assessment comprising of performance-based tasks applied in real-world and meaningful contexts can provide a holistic approach to competence assessment for seafarers (Ghosh et al., 2016)

Table 11: Example of task of authentic assessment

Authentic Assessment		
Tasks	Processes	Outcomes
• Set in a real-world context • Requiring an integration of competence • Comprising of forward looking questions • Ill-structured problems	• Requiring performance criteria to be provided beforehand • Evidence of competence to be collected by the student	Resulting in: • Higher student engagement • Ability to transfer skills to different contexts • Contextual and multiple evidence of competence • Validate and reliable student performance

Source: Ghosh et al., 2016

Traditional evaluation focuses more on the test of students' memory and understanding through written test or oral test, but for such an employable occupation as seafarer, there is no demonstration of practical skills, which cannot effectively show the actual skills of seafarer. According to many years of research by Samrat Ghosh and his partners., authentic assessment can enable candidates to have a higher degree of participation, and is more conducive for candidates to apply the skills they have learned to different situations, provide more relevant and diverse proof of competence, and thus more effective and reliable calculation of candidates' performance.

CHAPTER 6 RECOMMENDATIONS

6.1 Adjust the regulation framework toward GBS mode

As described in section 3.1, China's current regulations, policies and standards on seafarers' competence assessment fall under the RBR, the same as the STCW Convention as amended. A RBR approach generally involves rules that are precisely drafted, highly particularistic, and prescriptive; It gives regulatees advance notice as to what actions they can and cannot engage in, and provides no or limited exceptions, and limited flexibility in any specific factual context (Decker, 2018). China has nearly 70 METs with annual training capacity of more than 20,000 people. There is a big gap in the level of METs. However, according to the current regulations on seafarers' competence training and assessment, all METs only need to complete the training in accordance with the content and time specified in the training outline for seafarers and then pass the assessment of the same standard determined by the MSA in accordance with the training outline. METs have not yet formed a survival of the fittest mechanism (WSE, 2018). This greatly reduces the motivation for METs to take the initiative and innovate, which is a great obstacle to the improvement of seafarers overall quality and a waste of resources. The pure GBS approach is seen to: be flexible, encourage experimentation and alternative approaches to compliance, encourage regulatees to take more responsibility and think through consequences of actions, be more adaptive to changes in the environment and market, and to allow the regulator to tailor its approach to enforcement.

According to MSC.1/Circ.1394, Goal-based standards are high-level standards and procedures that are to be met through regulations, rules and standards for ships. GBS

are comprised of at least one goal, functional requirement(s) associated with that goal, and verification of conformity that rules/regulations meet the functional requirements including goals.

IMO goal-based standards are:

.1 broad, over-arching safety, environmental and/or security standards that ships are required to meet during their life cycle;

.2 the required level to be achieved by the requirements applied by classification societies and other recognized organizations, Administrations and IMO;

.3 clear, demonstrable, verifiable, long-standing, implementable and achievable, irrespective of ship design and technology; and

.4 specific enough in order not to be open to differing interpretations.

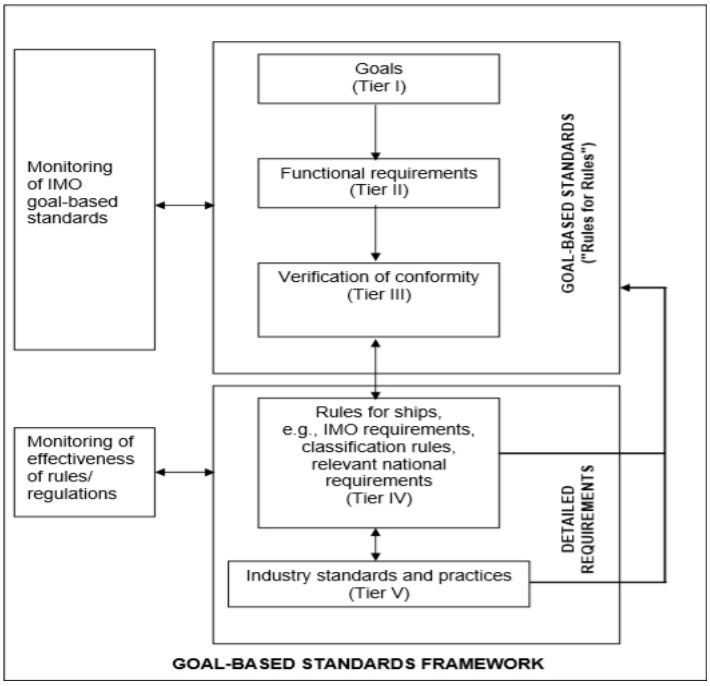

Figure 12： The framework of GBS
(source: IMO, 2019)

Compared with traditional prescriptive based regulations, GBS has obvious advantages. Firstly, GBS only set goals, there is no mandatory requirement for a

compliant method. It means GBS allows any methods as long as its compliance with the goal and functional requirements. GBS will promote innovation, new technology will develop faster in marine industry. Secondly, by GBS, IMO standards will be clearer and more reasonable, the problem of different rules in different classifications easily solved.

Adjust seafarers' competence training and assessment regulations and standards in accordance with GBS. The government shall no longer issue a unified training outline for the whole country, but only specify the target of seafarer training and assessment, so as to give METs enough flexibility, stimulate innovation, and drive the continuous improvement of the quality of Chinese seafarers.

6.2 Establish " three - party" assessment model

As shown in Figure 8 in Chapter 3, the current competence assessment of seafarers in China is completely managed and organized by MSA. METs and employers do not have enough say in the competence assessment of seafarers, which will also lead to reduced responsibility awareness of METs. They will only be high on exam-oriented training. MSA usually lag behind in the development trend and application of shipping industry and related technologies. There has also been some delay in responding to the industry's latest requirements for standards of competence for seafarers. As a result, the development of standards of competence for seafarers lags behind the needs of the industry. Therefore, it is suggested to reform the current management and implementation mode of seafarers' competence assessment to include METs and employers in the process of seafarers' competence assessment. MSA shall be responsible for the management. The METs which run the quality management system that has been verified meets the requirements, carry out the

assessment and issue the advice. Then, the MSA shall be responsible for issuing the COC after comprehensive assessment in combination with the suggestions of the shipping companies which is in charge of on board training of the candidate and the assessment result and advice from METs .

The three-party seafarer competence assessment model will enable METs and employers to participate in the seafarer competence assessment process. It is beneficial to enhance the responsibility consciousness of METs and to combine the assessment of seafarers' competence closely with the actual needs. It can urge METs to take improving seafarer's ability and quality as the goal rather than examination-oriented training, which is also more conducive to evaluating the candidates' practical operation ability.

6.3 Promote the contextualized assessment

Guided by the GBS standard, it clarifies the goals that should be achieved by the seafarers who have been qualified for the assessment. Taking authentic assessment with actual situations and tasks as the assessment questions. The application of training ships, simulator equipment and virtual reality technology in seafarers' competence assessment should be enhanced to closely combine seafarers' competence assessment with the actual working environment on board, so as to improve the effectiveness and reliability of seafarers' competence assessment. Therefore, it is necessary to study the application of new simulators, simulation equipment and data processing equipment in the process of seafarer competence assessment so as to continuously improve the efficiency and accuracy of seafarer competence assessment.

CHAPTER 7 CONCLUSION

Seafarers' competence plays a vital role in the safety of maritime navigation. Human factors have always been the main cause of maritime accidents. Competence assessment also plays an important role in ensuring and promoting the competence of seafarers. The STCW convention as amended, is the international convention on minimum standards for the assessment of the competence of seafarers. However, the convention does not provide for specific methods of assessment of seafarers' competence. As a result, different countries use different methods in assessing the competence of seafarers.

China is a country with more than 700,000 seafarers, a number unmatched by any other country. Therefore, the quality and skill level of Chinese seafarers also have a great impact on global shipping. By summarizing and analyzing the water traffic accidents related to Chinese seafarers in recent years, we find that there is still a certain need to improve the competence and level of Chinese seafarers. By analyzing the data of Chinese seafarers sent abroad, we find that the international recognition degree of Chinese seafarers is not matchable to the large scale of Chinese seafarers at present.

China's current regulations on the management of seafarers' competence assessment are established in accordance with the RBR model, and the whole process of operation is carried out by the MSA alone. METs, shipping companies and other employers do not have enough participation in competence assessment. METs shall conduct training in accordance with the contents and class hours stipulated in the training outline issued by the CMSA. This mode has a great limitation on the market of seafarers' training, the market has not formed the survival of the fittest mechanism,

the initiative innovation incentive of METs is not enough, and the vitality of METs has not been effectively released.

Through questionnaire and analysis of the reliability, validity, difficulty and discrimination of the current assessment methods for Chinese seafarers' competence. It is found that the current Chinese seafarers' competence assessment methods cannot guarantee the national unification in the competence assessment procedures and standards aspects, lack of reliability. The current assessment methods of seafarers' competence cannot truly reflect the actual competence of seafarers, nor can they fully and accurately identify the competence level of seafarers, hence, the validity and differentiation are insufficient. At the same time, some of the theoretical examinations of Chinese seafarers' competence assessment are too difficult and too heavy.

This thesis compared seafarers' competence assessment models in the Philippines, Singapore and the United Kingdom, did the current research on the management regulations and methods of seafarers competence assessment by relevant organizations and scholars. Combined with the research on the management and operation of the current Chinese seafarers' competence assessment methods in China, the author believes that reforming China's current regulations on seafarer competence assessment through GBS mode will release the vitality of the seafarer training market, encourage METs to take the initiative to upgrade their training capabilities and standards， motivate seafarers to improve their competence level. It will positively promote the overall competency and level of Chinese seafarers.

Enhancing the participation of METs, shipping companies and other employers in seafarers' competence assessment will also play a positive role in fulfilling the

responsibilities of relevant units and promoting seafarers' sustainable competence. Meanwhile, authentic assessment should be carried out. Increasing the application of virtual simulation technologies in seafarers' competence assessment process and closely integrating seafarers' assessment of competence with actual work scenarios and tasks can more truly and accurately reflect the actual competence level of seafarers and enhance the reliability and validity of seafarers competence assessment in China.

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APPENDIX

QUESTIONNAIRE

Occupation：

Seafarers from china mainland
seafarers from Taiwan/ Hongkong/ Macao
seafarers from other country or region
Faculty of METs
Students majored in maritime
The workers from shipping company of seafarers service agency
Officers of MSA
others

Questions:

1. Do you think the theoretical and practical content distribution of seafarers assessment in China is reasonable

Good Acceptable Bad

2. Does the current method of Chinese seafarers' competence assessment truly reflect the seafarers' true ability?

Good Acceptable Bad

3. Does China's current approach to assessing seafarers' competence promote maritime safety?

Good Acceptable Bad

4. Is the current Chinese seafarer competence assessment method conducive to the development of the seafarers?

Good Acceptable Bad

5.How does the current Chinese seafarers' competence assessment play a role in ensuring maritime traffic safety?

Good Acceptable Bad

6.Do you think China's current method of seafarers’ competence assessment is reasonable?

Good Acceptable Bad

7.Are the specific methodologies and evaluation standards adopted reasonable?

Good Acceptable Bad

8. Does the content of the assessment meet the requirements of the Convention?

Good Acceptable Bad

9.Is the current form of assessment of seafarers' competence for METs + examination + onboard exercise used in China reasonable?
Good Acceptable Bad

10.Suggestions on the assessment of Chinese seafarers.