April 2025

Prime Shipmanagement Guidelines

Implementation of Resilience Engineering in Shipmanagement

Ver. 1.00

[English]

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Revision History

No.	Revision Date	Category	Description
1.0	2025.04.20	New	Newly issued.

Introduction

With the rapid technological advancement and expansion of global trade in the recent years, ship management is undergoing the period of unprecedented transformation. Introduction of new technologies and compliance with the diversifying environmental regulations are improving the ship's safe operation and management efficiency, but also bringing new challenges.

This Guidelines shows the new policy for the ship management in maritime transportation (Prime Shipmanagement Guidelines) to establish and maintain the safety standards of the highest level while keeping up with the latest technologies and many environmental regulations.

Background and challenges

Personnel including seafarers as well as companies now have to obtain new knowledge and capabilities, which were not required in the past, resulting in the increased burdens. Until the 1990s, initiatives taken to secure the safety against maritime incidents were those addressing equipment and hardware. Since the introduction of the ISM Code[1] in the latter half of the 1990s, software has also been addressed, but the occurrence of various maritime incidents is still seen. And it has been found out that the human factor accounts for the majority of the causes.

Policies

In order to achieve the utilization of success factors, which is the concept of "Safety-II" advocated as an initiative for the safety management, and the incorporation of resilience to flexibly address the changing situation, ClassNK proposes a new and ideal way of ship management mainly focusing on the following three points.

(1) Competency management (Management of capabilities)

The safe operation of the ship is closely related to the ability and training of all personnel including seafarers. System with the emphasis on the management of the personnel's ability and training, especially focusing on the training to acquire new technologies and to improve the ability of emergency response, is proposed.

(2) Process management (Functional SMS Manuals)–

Development of the practical and functional SMS manuals is proposed as a means to effectively manage the processes. This prevents the SMS manuals from being mere formality and assists the steadfast decision-making and execution on the site.

(3) Knowledge management (Management of knowledge)

Knowledge management is proposed to effectively collect, organize, share and utilize knowledge the organization has accumulated. System is to be developed to effectively manage

[1] "The International Safety Management (ISM) Code" is one of the international regulations set by the International Maritime Organization (IMO), providing a standard for the safe management to ensure the ship's safe operation and the marine environment protection.

and fully utilize know-how of the safe operation and knowledge to address the new technologies, in addition to the traditional maritime skills, among all the relevant personnel within the organization, regardless of onshore/offshore. Furthermore, creation of new knowledge by leveraging the abovementioned knowledge is also explored.

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This Guidelines proposes the incorporation of resilience engineering into the prime shipmanagement, subject to continuous reviews and revisions to evolve into more concrete guidelines.

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Contents

Chapter 1 General

1.1 Objectives

The purpose of this Guidelines is to propose the incorporation of “Safety-II” and “Resilience engineering,” which are the concepts advocated as an approach for the safety management, into the ship’s safe operation management.

1.2 Definitions

The following definitions are applied to this Guidelines.

1.2.1 Safety-II

Safety approach to examine the reasons for “success” to increase the likelihood of success, instead of eliminating the causes of “failure.” It is labeled as Safety-II as a new concept for safety to differentiate from the traditional one.

1.2.2 Safety-I

Traditional concept to prevent accidents and troubles occurring in the modern sociotechnical systems by eliminating the factors leading to danger and risks. As the new safety concept is labeled as Safety-II, the traditional one is referred to as Safety-I for comparison.

1.2.3 Resilience engineering

Engineering (techniques, methods) to realize “resilience,” which is a term to represent “flexible strength,” meaning “capacity to recover,” “ability to return to the original state,” or “nature to bounce back.” Resilience enables to achieve the goal not only by strength but by flexibility, and addresses technical systems and social systems as well as sociotechnical systems as their combination.

1.2.4 Safety Management System: SMS

System to manage safety stipulated by the shipowner or the ship management company in accordance with the ISM Code under SOLAS Chapter IX.

Chapter 2 Safety-II and Resilience Engineering

2.1 General

Learnings from the experiences of significant maritime incidents were mainly incorporated as the measures addressing equipment and hardware until the 1990s. Though the ISM Code was introduced later, the occurrence of maritime incidents continued, most of which turned out to be related to the human factors. Soon after the human factors started gaining attention, there was a period where humans were considered as a less trustable system component compared to machines, and the consideration of safety measures mainly focused on the promotion of automation to the extent possible. However, now the research is ongoing to explore the new way of safety with the recognition that it is impossible to automate all the tasks and with the focus of humans as an existence capable of showing outstanding performance despite occasional errors. The concept of Safety-II and the methodology of resilience engineering introduced in this Guidelines have been developed in the abovementioned context.

The Society proposes to incorporate the concepts of Safety-II and resilience engineering into the ship's safety management with a view to contributing to the safety of the shipping industry.

2.2 New safety concept of Safety-II

Dr. Erik Hollnagel, a world-renowned expert in the field of human factors, argues that the traditional safety approach is insufficient in the modern age where the system is getting complicated rapidly and that a new definition is necessary. Now the concept of safety based on the new definition he advocates is labeled as Safety-II, while the safety under the traditional approach is referred to as Safety-I for the sake of comparison. These two types of safety are described as below.

2.2.1 Safety-I: Reducing what's not working as much as possible

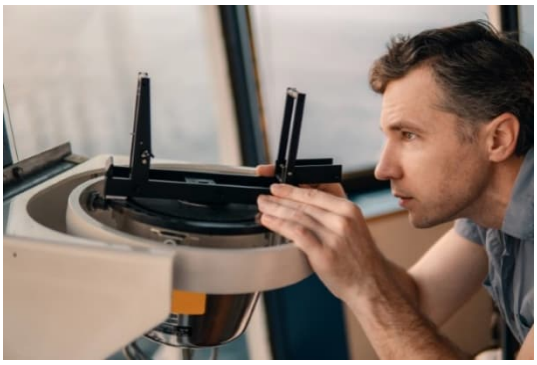
"Safety" has been defined as "the state where there is no danger or failure." The "risk-based thinking and safety measures," which has now become a common concept, is also based on the same idea with the emphasis of the elimination of risks (danger), as much as possible. Dr. Hollnagel redefined the traditional safety approach as Safety-I.

Safety-I develops procedures based on the expected situations, implements and assesses them, studies the causes of what's not working (defect, failure, incident, near miss), if any, and eliminates them to update the procedures. It is considered that "the safety would be improved" by ensuring to maintain the cycle to achieve the acceptable result (see Figure 1). This is the outline of the traditional approach to explore the safety based on Safety-I. This approach has achieved great results so far, but it is reaching the limit in a sense, and thus we are now in the era where a new approach is sought. More specific explanations are as follows.

Now we are experiencing "successes" far more than "failures" in our daily lives. It is naturally

attributed to the efforts of learning from the predecessors' precious experiences of failures, or the result of Safety-I, but it may be said that the less failures we encounter, the less opportunities we may have to improve the safety.

If the (statistical) probability of failure is 1/10,000, only one failure out of 10,000 cases is solely focused and 9,999 cases of successes are left unattended (see Figure 2). However, if the 9,999 cases of successes are closely examined, various adjustments or good practices that enabled these successes are discovered. The Safety-II concept is drawn up from this viewpoint.



Function ⇨ Success ⇨ Acceptable result ☺
(Expected operation, normal behavior) (No harmful events)

Malfunction ⇨ Failure ⇨ Unacceptable result ☹
(False operation, violation, error) (Incidents, accidental events))

Figure 1 View of successes and failures under Safety-I[2]

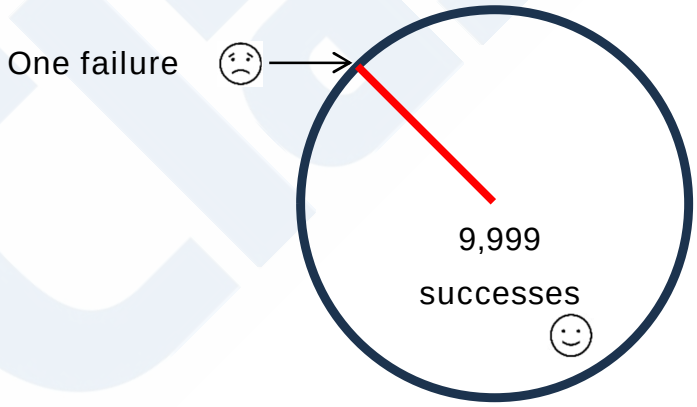


Figure 2 Imbalance of what's working and what's not[3]

[2] Reference 13) p437

[3] Reference 13) P437

2.2.2 Safety-II: Increasing what's working as much as possible

Dr. Hollnagel focuses on the fact that incidents and troubles occurring in the sociotechnical systems cannot be completely avoided by only the traditional approach to eliminate the factors leading to danger and risks. Instead, he considers it more reasonable to examine the reasons for "things that go well" to increase its likelihood rather than to eliminate "things that might go wrong."

The Safety-I concept to eliminate failures and secure the safety makes intuitive sense and one may think there is no need to have doubts about it. Safety-I tangibly improved the safety level back in the period with the low safety level, frequent accidents, and the simpler systems. It is true that the majority of industries have seen the dramatic reduction in the occurrence of incidents over the last 50 years.

However, as all the modern practical operations, including shipping, are incorporated in the complex sociotechnical systems dependent on computers, information and telecommunication, it is becoming more and more unlikely that the traditional way of thinking can stand.

Fundamentally speaking, failure occurs even if the safety measures under Safety-I are thoroughly implemented. Furthermore, it is not easy to find out the root cause in a situation where the frequency of failure is low and a failure is sometimes (or always) irreproducible in the intricate systems.

In this context, the Safety-II concept opens up possibilities to handle the unpredicted situation by focusing on the numerous cases of successes that used to be unattended and by sharing the learnings from them to enable people to flexibly take appropriate actions.

For example, the Japan's Act on Preventing Collision at Sea compliant with the Convention on the International Regulations for Preventing Collision at Sea, 1972 stipulates the basic maritime traffic rules including the appropriate watchkeeping methods, actions by a stand-on vessel and a give-way vessel, sound signals, technical details of lights and shapes, etc. As such, the safe navigation is achieved by complying with the laws and regulations with the limited visibility or in case of two vessels meeting. This is the navigation with the mindset of Safety-I.

However, situations that cannot be handled by only observing these rules may frequently happen in the actual voyage. Paragraph (ii), Rule 38 of the Act stipulates that a departure from the requirements of the Act may be permitted in case of any special circumstances with the immediate danger as per the preceding paragraph. As the ship may encounter various situations at sea, it is difficult to expect all the circumstances and reflect them into the rules. Judgement on a case by case basis corresponding to each specific situation is sometimes required, and thus the flexible adjustment in accordance with the situation by personnel on duty contributes to the safe operation in special circumstances with the immediate danger.

Furthermore, the safe navigation is achieved not only by the adaptation to changes but also by necessary actions and preparations through the prediction backed by the accumulated knowledge and experiences before being affected by any changes or impacts.

This is the Safety-II concept advocated by Dr. Hollnagel. And the methodology to realize Safety-II is resilience engineering.

Table 1 shows the contrast between the ideas of Safety-I and Safety-II.

Table 1 Comparison of Safety -I and Safety -II[4]

	Safety-I	Safety-II
Definition of safety	That as few things as possible go wrong.	That as many things as possible go right.
Safety management principle	Reactive, respond when something happens or is categorized as an unacceptable risk.	Proactive, continuously trying to anticipate developments and events
Description of accident	Accidents are caused by failures and malfunctions.	Things basically happen in the same way, regardless of the outcome.
Purpose of accident investigation	To identify the causes.	To understand how things usually go right as a basis for explaining how things occasionally go wrong
View of the human factors	Humans are basically predominantly seen as a liability or hazard.	Humans are seen as a resource necessary for system flexibility and resilience.

2.3 Resilience engineering

"Resilience" of resilience engineering means the characteristics compounding the "nature to bounce back," "ability to return to the original state," and "capacity to recover," which can be summarized as flexibility. "Engineering" means a "methodology to incorporate something." Therefore, resilience engineering literally means a "methodology to incorporate flexibility into the systems." Specific explanations are as follows:

Taking the ship operation as an example, the ship and the onboard seafarers constitute the sociotechnical system. The sociotechnical system here refers to the system where the social system, such as individuals and teams, and the technical system as represented by machines and equipment are closely related. The classic definition of resilience is "the ability to continue working with performance maintained even when the sociotechnical system undergoes any internal variability or

[4] Reference 1） p161

external disturbance, and to mitigate the level of performance degradation and recover to the original state as soon as possible even when the performance degradation is unavoidable." Meanwhile, "if the organization is capable of providing the same performance as usual under the expected or unexpected conditions (variability, disturbance, and opportunities), the organization is deemed to be resilient" has recently been proposed as the definition. Based on this new definition, the purpose of resilience engineering is considered to ensure that the organization can take actions effectively in accordance with the conditions it faces on a daily basis, or in other words, to ensure that daily actions are successfully fulfilled. It is to be noted that the conditions the company faces on a daily basis may include both slight variability or external disturbance that may happen regularly and those more significant and that happen only occasionally.

However, the expression "the organization is deemed to be resilient" is simplified and, strictly speaking, "the organization is deemed to have the potential to give a resilient performance" is more reasonable. Making appropriate adjustments in accordance with the situation while keeping to the procedures is required in daily works. Such adjustments are flexibly devised (or inspired based on each situation, rather than being documented as procedures in advance. Adjustments are only to be inspired adaptively especially against significant disturbance that rarely happens. Resilient performance consequently cannot be uniquely defined and rather it varies among the decision-makers and the actors. That is why it is necessary to consider how to have the organization acquire the abovementioned potential. Resilience engineering proposes that the following four potentials are required for the organization for this purpose.

2.3.1 Four potentials required for the organization to achieve resilience engineering

(1) Potential to respond: Ability to respond to regular or irregular variability and disturbance

The organization's inability to properly respond to disturbance or internal variability in the sociotechnical system would lead to the existential crisis. Therefore, the potential to respond is necessary. In case of a ship, the potential to respond is considered to be exerted when appropriate counteractions are taken against the rapid change of weather or sea states, impacts of obstacles or abnormalities in engines or steering equipment.

(2) Potential to monitor: Ability to monitor what could affect the organization's performance

Without monitoring the sign of changes, the organization responds only reactively whenever any changes occur, which makes it more likely to fail in counteractions. Therefore, the potential to monitor is also necessary. In case of a ship, a capable seafarer is able to detect the sign of rapid changes in weather or sea states or abnormalities in engines earlier and to get prepared for the occurrence of events with prediction. This means that the potential to monitor is exerted.

(3) Potential to learn: Ability to learn the right lessens from the experience accumulated by the own company or by the others

In the organization that does not learn from the experience nor update/reinforce the potential to respond and potential to monitor based on the learnings, these potentials would get outdated and degraded, which makes the organization impossible to stand from mid- and long-term views. Therefore, the potential to learn is also essential. In case of a ship, the willingness to learn from the events experienced by the competitor's ships or ships of different types is desirable, while learning from the events experienced by the own company or ship is taken as granted.

(4) Potential to anticipate: Ability to anticipate threats and opportunities that may realize in the future, including changes or disturbance.

The organization's inability to anticipate a great threat that may happen in the future would lead to the existential crisis with failure to address these upheavals. Therefore, the potential to anticipate is also necessary. When threats are anticipated, the outcomes of the anticipation are utilized by connecting them to the update or reinforcement of the potential to respond and the potential to monitor, in the same way as the outcomes of learning. In case of a ship, reinforcement of watches and handover of watchkeeping taking into account the seasonal fishing vessels' operations as well as engine room watches and handover to prepare against the occurrence of sludge and choking of strainer due to the fuel oil are the examples of anticipation to prevent the accidents even before the occurrence of abnormalities.

The higher the level of these four potentials to be exerted by the organization, the more likely it is that the appropriate resilience is performed corresponding to the situation. The above is the basic recommendation of resilience engineering.

2.3.2 Means to achieve resilience

The organization needs to satisfy the following requirements to maintain the abovementioned potentials at the high level and further improve them. It is impossible to enhance the four potentials if the below requirements are unmet.

(1) Cultivation of competency

In order to have the four potentials of resilience performed properly, it is essential to ensure that the personnel engaging in the actual operations have the competency herein. Continuous provision of training to improve the competency is desired under the Safety-II concept, but scenario training to ensure the acquisition of the traditional "correct procedures," i.e. the Safety-I concept, is also to be implemented as a preparatory phase. The competency

specifically consists of the following elements:

a) Knowledge

This refers to the knowledge of principles of system behaviors and standard procedures. The concept of resilience engineering allows personnel to take actions flexibly in accordance with the circumstances, but it must not be unprincipled. Rather, appropriate adjustment is expected to be taken depending on the situation by utilizing the knowledge as the basis of it.

b) Skill

In addition to technical skills as represented by skills of navigation or machine operations, non-technical skills are also essential, such as the ability of situational awareness, decision-making, task management and communication. These non-technical skills also include the basic attitude toward the fulfillment of tasks.

(2) Resource deployment

Even if the competency is improved, it is still difficult to perform the competency if there is a shortage of resources necessary to execute the tasks. Resources here include the required personnel, materials and equipment, electricity and fuel, which is summarized as personnel and goods necessary to perform the competency. Resources are to be deployed to the departments (sites) in need by the time when they are needed, not just being stored somewhere in the organization. The ISM Code stipulates that the company is responsible for ensuring that adequate management resources (personnel, materials, money, instructions, training) are provided to carry out the SMS. Appropriate implementation of the SMS is the basis of resource deployment.

(3) Daily commitment to learning

Ship navigation is conducted under the instruction of the captain and chief officers, who have rich experiences and competency. As such, the potential to respond and the potential to monitor are considered to be at the high level to some extent. Meanwhile, the continuous reinforcement of these potentials by leveraging the learnings from the experiences of the own ships or others is still important to enhance resilience.

Learning improves the potential to respond and further sophisticates the imagination that serves as the basis of anticipation. The efforts to grow the potential to respond (swift response, preventive actions) also provide necessary experiences for the betterment of learning and prediction.

In learning from experiences, it is to be highlighted that not only failures but also good practices are to be focused to draw learnings for improvement and that such commitment

embodies the Safety-II concept.

2.3.3 Incorporation of resilience engineering into ship management

The next chapter describes the specific means as shown below to incorporate the Safety-II concept into the ship management business, where the Safety-I concept of developing and executing the procedures and reviewing the outcomes has traditionally been the mainstream. In other words, the chapter below explains in a concrete manner how to incorporate resilience engineering into the management of the ship's safe operation.

(1) Competency management (Cultivation of competency)

(2) Process management (Functional SMS manuals (Resource deployment))

(3) Knowledge management (Daily commitment to learning)

Monitoring and anticipating

This column gives some thought to the potential to “monitor” and the potential to “anticipate” necessary for resilience.

“Monitoring” is to pay attention to what has happened just now in front of us or is going to happen. Taking actions based on the visible data or information is the realization of the potential to respond based on monitoring, which is the fundamental and essential activity to perform resilience.

“Anticipating” is to pay attention to what has not yet happened but may happen from now on. Even if the horizon is visible, what is happening beyond the horizon is out of sight. “Anticipation” is to predict something beyond the visibility, which is enabled by the accumulation of learnings and experiences.

To further enhance resilience, it is important to add proactive preparations and preemptive actions based on imagination and “anticipation” to reactive activities based on monitoring. The expansion of knowledge by learning and the accumulation of experiences of responding to many events are effective to improve the potential to “anticipate.”

The following introduces some examples of anticipation plausible in the ship operation in the hope of providing some tips to visualize the unknown “anticipation.”

Table 2 Examples of monitoring and anticipating

Monitoring	Anticipating
To conduct an inspection after the voyage in the adverse weather as necessary, in addition to the regular inspection of the hull structure including tanks and holds.	Hull damage (cracking, bending) often occurs symmetrically. If damage is detected in one side, check the same part on the other side, too.
To monitor the cargo during the cargo sailing (temperature, measurement of bilge depth, gas detection, etc.)	To reinforce the monitoring of bilge depth, etc., with the anticipation of increased bilge water due to the rainfall in the stockyard at the port of loading.

To enhance the watchkeeping by all means of vision, hearing, radars, etc. with the limited visibility.	To plan the safe route with the anticipation of seasonal dense fog and the existence of fishing vessels and coastal ships.
To inspect and monitor the strainers and purifiers.	To use the fuel oil only after the confirmation of its safety through the property analysis with the anticipation of crude oil being used.
To conduct the watchkeeping and engine monitoring based on the thorough plan.	To ensure to be on standby with the anticipation of accidents and machinery failures during the navigation in narrow channels or shallow waters and when entering or departing the port.

Chapter 3 Competency Management

3.1 General

It is important to manage the competency to utilize technical and non-technical skills in accordance with the circumstances in order to incorporate resilience engineering into the ship's safe operation.

Combining the "Safety-II concept of exerting resilience in accordance with the circumstances based on the personnel's skills and increasing the things that go well to achieve the safety" with the traditional "Safety-I concept of eliminating risks based on the past failures to achieve the safety" for incorporation into ship management requires to clarify the necessary skills and to manage the achievement level. In other words, it is necessary to establish the system to visualize the skills required for the personnel as actionable competencies and reinforce and manage them.

Clarification of the competencies required for each role or job position contributes to identify the education and training required for the personnel and enables the personnel to refer to the competencies required for different workplaces or the higher positions as a part of their career development.

3.1.1 Clusters of competencies

Skills required for the safe operation, including navigation, engine, operation and cargo handling, are divided into the following three clusters of the actionable competencies for further management and enhancement.

(1) Technical Competency

Competencies related to the maritime knowledge of navigation and actual operation as well as the techniques directly required for the safe operation.

(2) Core Competency

Competencies that serve as the core for the safe operation, including the company's policy, safety culture, compliance with the laws and regulations, and roles and responsibilities of each personnel.

(3) Behavioral Competency

Competencies related to non-technical skills including situational awareness, decision-making, communication and teamwork.

(See Appendix 1: Behavior Competency assessment and Verification for Vessel Operators (OCIMF))

3.2 Methods to establish the competency management system

The following processes are needed to establish the competency management as a system.

(See Figure 3)

3.2.1 Setting of business goals and KPIs

The goals to be achieved in the ship management business are to be defined. The goals defined here would become the basis of identification, assessment and management of necessary competencies.

Methods to measure the progress and outcomes of each initiative toward the achievement of the business goals as well as the key performance indicators (KPIs) are to be defined.

3.2.2 Identification of the required competencies, development of competency model

Competencies required to achieve the business goals are to be identified and the ideal "competency model" is to be developed. The following items are to be taken into account in the identification of the required competencies:

a) Relevant conventions, laws and regulations (SOLAS, STCW, etc.);
b) Industrial guidelines;
c) Company specific rules, including the SMS and other manuals;
d) Technical elements, including qualifications and training records; and
e) Non-technical elements, including the ability of situational awareness, decision-making, communication, teamwork, attitude toward the fulfillment of tasks.

(See Appendix 2 : ClassNK Maritime Competency Framework)

3.2.3 Assessment of the current status of the competencies

Methods and tools to assess the competencies are to be planned. (Who/what/when/where/how to evaluate is to be clarified.)

Assessment is to be conducted by combining multiple methods such as behavior observations (observing the personnel's attitude in their daily tasks to assess the required behavioral characteristics and performance), interviews and discussions.

The competencies required for the assessor are to be identified and the personnel who maintains the competencies at the high level is to carry out the assessment.

3.2.4 Mapping (analysis) of competency gap

The current status of the competencies is to be compared with the ideal competency model and the difference is to be mapped as the competency gap. It is required to prepare effective countermeasures such as trainings and a plan to execute them to clear the identified gap.

It is to be noted that the gap identified in this process is not to be mixed with problems and weakness in the relevant operational processes.

Assessment of the competency gap is to cover at least the following items:

a) Competency based on the criticality;
b) Business goals of the organization;
c) Individual job grade and long-term competency development plan (career plan);

d) Refresher training requirements; and
e) Crew co-ordination.

3.2.5 Plan to clear the competency gap and its execution

Training and other means to clear the gap are to be identified and prioritized based on the mapping of the competency gap.

In this process, involving the subject personnel to properly reflect their career plans and opinions is important to encourage their proactive participation in the training and learning toward their goals and to effectively achieve the improvement.

Training is to be planned and carried out with the clear definition of the corresponding qualifications of the training provider. Assessment of the training provider is also necessary.

At least the following items are to be considered in planning the training:

a) Competency of the individuals;
b) Competency required for the current role or job grade;
c) Competency required for the future role or job grade;
d) Compliance with the legal requirements;
e) Characteristics of specific ships or ship types; and
f) Crew co-ordination.

3.2.6 Monitoring, review, assessment

Internal audit on competency is to be planned and executed. The frequency of the internal audit is to be the same as the one required by the SMS.

(1) Management review on competency is to be carried out at least once a year and the outcome is to be documented including the action list compiling the items covered. At least the following is to be included in the assessment items of management review:

a) Business goals;
b) KPIs for the competency management;
c) Outcomes of the internal audit;
d) Feedback from clients;
e) Incident reports;
f) Validity of the competency management system;
g) Follow up items from the previous management reviews;
h) Changes that may affect the competency management system;
i) Recommendations for improvement;
j) Revisions of rules and technical requirements;
k) Statistical data of the subject personnel’s performance;

l) Assessment of competency against the KPIs and business goals; and

m) Recruitment, promotion, retiring processes.

(2) Competency of the individuals is to be regularly reviewed.

Review is to be carried out by focusing on the knowledge, skills and behaviors. A lack of knowledge is to be differentiated from inappropriate behaviors in the assessment, and the corrective actions in accordance with the situation are to be prepared respectively.

(3) Effectiveness and efficiency of training are to be assessed for the items shown below. Procedures for assessment are to be established.

a) Training course;

b) Training provider; and

c) Assessor

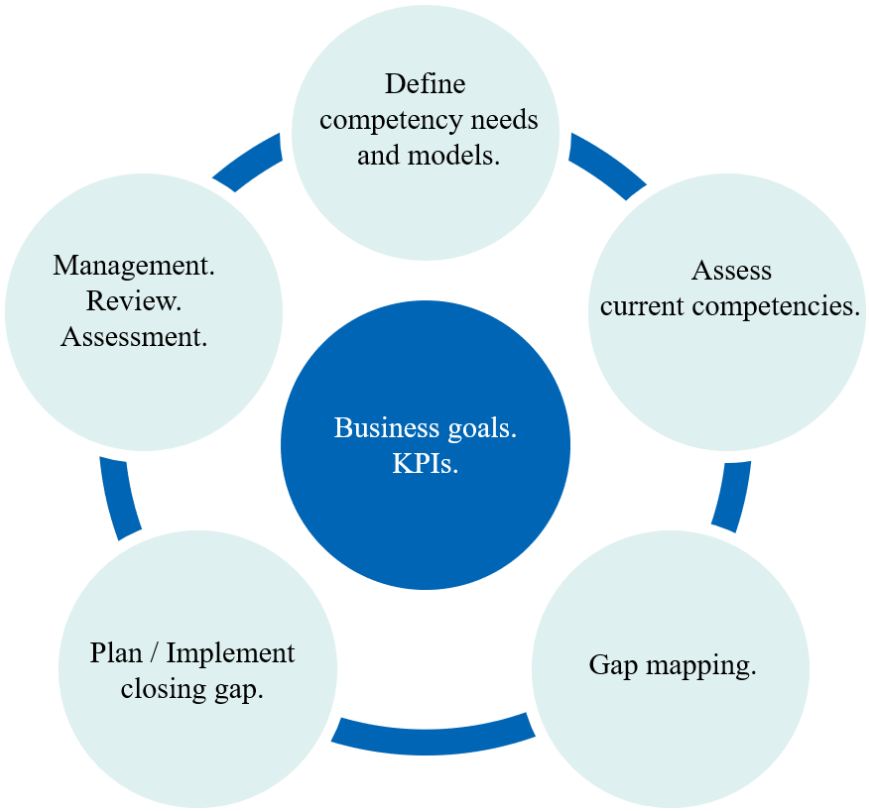


Figure 3 Conceptual diagram of competency management process

3.3 Reinforcement of resilience by competency management and its effect

Performing technical and non-technical skills in specific tasks and managing them as competency contribute not only to ensure the safe operation but also to cultivate the ability to flexibly respond to the sudden changes in the circumstances and unpredictable events, leading to the reinforcement of resilience of the entire organization.

Chapter 4 Process Management (Functional SMS)

4.1 Resilience engineering and SMS

Since the ISM Code came into force in 1998, the shipowner and the ship management company (the Company) have been operating the safety management system (SMS) as process management. The ISM Code, requiring the "establishment of the safety management system," was developed based on the "PDCA cycle" with reference to the ISO standards, which specifically is a cycle of making a plan (Plan), implementing it (Do), confirming the results (Check), making necessary improvements (Action), and reflecting them into the plan. As it stands on the viewpoint to ensure the safety by eliminating the factors that may lead to risks, it is similar to the traditional "Safety-I" concept.

Dr. Hollnagel, who advocates Safety-II, does not deny Safety-I. The PDCA cycle and the Safety-I concept remain to be the basis of the SMS. The point is that he focuses on successes and good practices and highlights the significance to reinforce the four potentials, while taking these traditional concepts as the precondition.

4.2 SMS manuals

The first step in the operation of the SMS is to develop the SMS manuals. Companies have been developing their SMS manuals in accordance with their own safety management policies. The SMS manuals consist of the manuals of major onboard duties, checklists, recording formats, etc. as well as case studies of incidents/disasters and measures to prevent their recurrence.

However, repeated reinforcements and revisions to the relevant regulations have increased the volume of each company's SMS manuals, which may result in the difficulty to find out necessary information.

Such difficulty is also attributed to the replacement of the personnel responsible for the management of the SMS manuals and changes in the specifications of document management systems, leading to the situation where even the personnel in charge cannot grasp the whole picture of the SMS manuals. Furthermore, there is a case where the additions of measures to prevent the recurrence of incidents and disasters make the SMS manuals voluminous. Possible measures to prevent the recurrence of incidents and disasters are generally the actions from the physical, technical, and administrative (human) aspects (see Table 3).

"Actions from the administrative (human) aspect" are more likely to be adopted as the measures to prevent the recurrence, as they require the less implementation costs and time compared to "actions from the physical or technical aspects." Specifically speaking, the addition of various manuals and checklists has let the SMS manuals get bloated.

"Actions from the administrative (human) aspect" are effective soon after the implementation, but their details and intentions may become unclear over time due to the replacement of crews and the

responsible personnel, which is why careful consideration is required in their implementation.

Table 3 Types of measures to prevent the recurrence

Type	Methodology
Actions from the physical aspect	To achieve the safety by setting physical restrictions. e.g. To limit the entry by locking the hazardous zone.
Actions from the technical aspect	To achieve the safety by technical means. e.g. Interlocking, fail safe mechanism, alarm to be raised upon the approach by personnel to the hazardous zone.
Actions from the administrative (human) aspect	To achieve the safety by incorporating administrative actions (rules, procedures, initiatives addressing human factors) into manuals or checklists. e.g. To implement the procedures of obtaining the approval from the administrative personnel prior to the entry into the hazardous zone.

4.3 Positive and negative effects of manuals

While developing and operating the SMS manuals in an effective manner are considered to be essential for the management of the ship's safe operation, it is generally perceived that manuals have the positive and negative effects as shown in Table 4.

Table 4 Positive and negative effects of manuals

Positive effects	Negative effects
Standardization of tasks and improved consistency; Better efficiency and less time required; Serving as materials for education and training; Contributing to the compliance with laws and regulations; and Transparency of tasks.	Lack of flexibility; Excessive dependency and overconfidence; Burden of maintenance and update Lowered motivations; and Manuals becoming mere formality.

4.4 Positive and negative effects of checklists

Similar to manuals, checklists also require due consideration for their potential negative effects as well as benefits. Positive effects brought by checklists include the prevention of oversight and omission, the improved efficiency of tasks, and value as records. On the other hand, excessive dependence on checklists may cause negative effects such as "degraded flexibility" with the omission in checking the items other than those in the checklists as well as "familiarity hollowing out the checklists" and "checks for the sake of checklists," with which the personnel become unwilling to understand the objectives of check items and move on to the next phase without sufficient checks.

(See Table 5)

Table 5 Positive and negative effects of checklists[5]

Positive effects	Negative effects
Prevention of oversight and omission; Clear prioritization of check items; Consistent and standardized check work; Serving as materials for education; and Value as records.	Degraded flexibility; Burden of maintenance and update; Increased workload due to the voluminous checklists; Familiarity and hollowing out over time; and Less attention to the items not included in the checklist.

Manuals and checklists bring huge benefits and they are considered to be essential as far as operated in a functional and effective manner. Meanwhile, it is necessary to pay close attention to the possibility that their negative effects may hamper resilience.

4.5 Development of functional SMS manuals for the on-site use

Development of the understandable and functional SMS manuals is hereby proposed as a means to optimize the operation of the safety management system. Development of the functional SMS manuals requires to consider the following items, with both positive and negative effects of manuals and checklists in mind:

(1) Clarification of the objectives

To clearly define the objectives and develop the methodologies and procedures to achieve

[5] Reference 4)

them in a systematic manner.

(2) Concise and understandable contents

To simplify and unify the format and adopt the understandable expressions. To always stand on the user's viewpoint and consider making the contents and structures user-friendly and practicable, such as realizing the visually understandable structure with diagrams.

(3) Verification of the effects, feedback from users

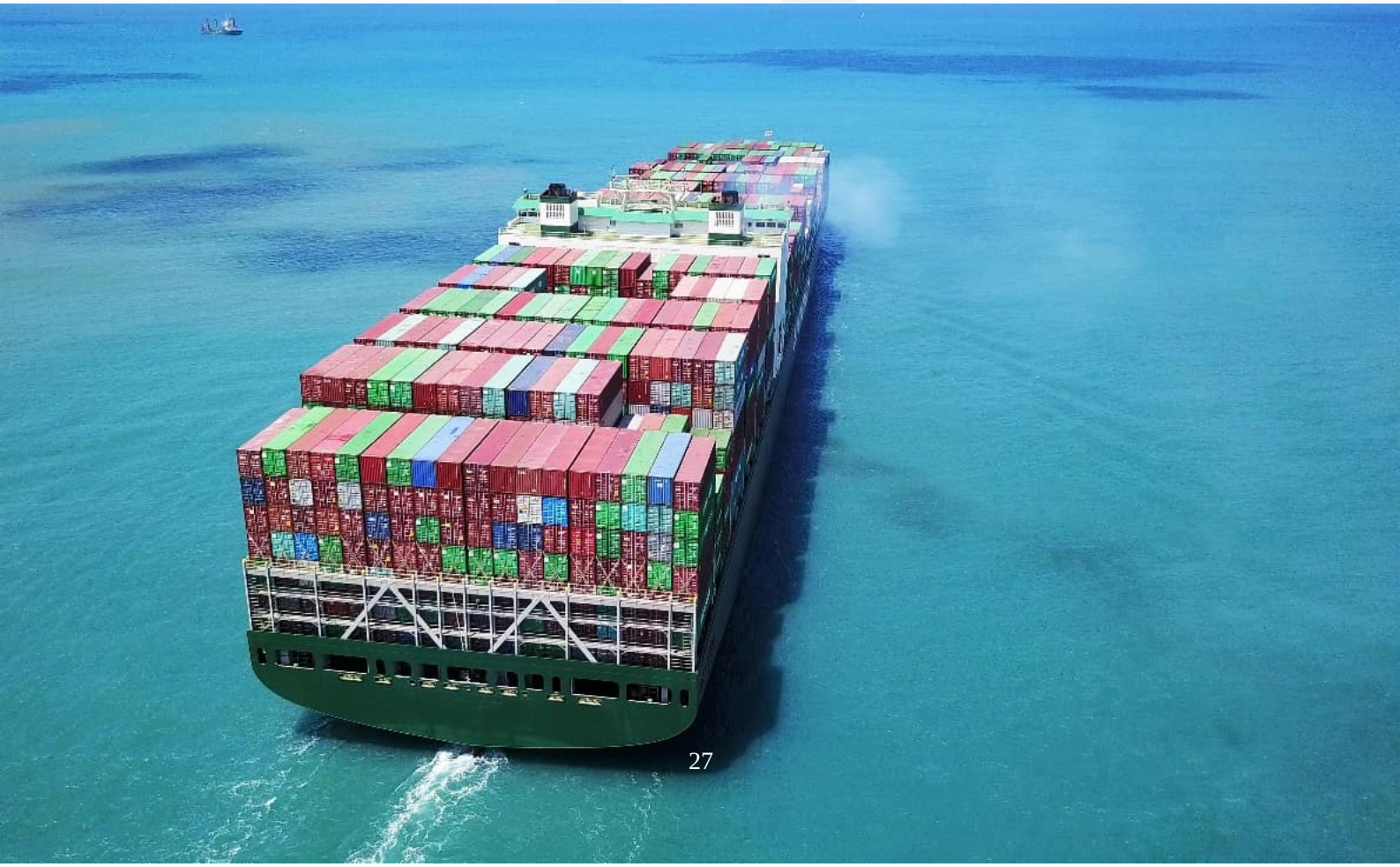
To regularly monitor how manuals are utilized, manage the usage rate by KPIs and reflect the feedback from the site in order to prevent the manuals from being unutilized and mere formality.

(4) Regular reviews and updates

To regularly update the manuals corresponding to changes in tasks, renewal of equipment, and revisions of the rules.

4.6 Achieving both functional manuals and resilience engineering

It is important for the management of the ship's safe operation to achieve both the operation of the safety management system based on the SMS manuals (Safety-I) and the reinforcement of resilience engineering (Safety-II). Implementation of the functional SMS manuals is a significant and valuable activity that reduces the burden on personnel including seafarers and achieves the safe operation, eventually leading to the improved work style and promotion of well-being.



Safety management manuals and checklists in the aviation industry

The aviation industry has been aware of the importance of the safety management manuals and checklists from the earlier stage. The concept of pre-flight checklist was introduced triggered by a crash of the prototype aircraft in 1935. This accident occurred due to the negligence before the takeoff in unlocking the rudder and elevator surface controls that control the aircraft's lateral and vertical movement in the air. Based on the learning, the pre-flight checklist was developed and spread across the aviation industry with its effectiveness widely recognized. Similar to the checklist, the effectiveness of managing the safety as system was acknowledged based on experiences of many accidents, and the ICAO (International Civil Aviation Organization) made the introduction of the safety management system mandatory on a global scale in 2001.

The shipping industry has introduced BRM (Bridge Resource Management) and ERM (Engine Room Resource Management), which are widely known as the means originally developed in the aviation industry.

Furthermore, Capt. Terje Lovoy, an ex-aircraft pilot, is researching how to apply the aviation industry's methods to the shipping industry for the operation of the safety management manuals and checklists. He specifically advocates the way to incorporate (implement) the simple and functional safety management manuals and checklists into the maritime SMS.

(See Appendix 3: Simple SMS and the Lovoy Method)

Chapter 5 Knowledge Management

5.1 Knowledge management and the ship's safe operation management

5.1.1 Knowledge management and resilience engineering

Knowledge management is to manage the sharing and utilization of knowledge. Reinforcement of resilience of the individual and the organization is enabled not only by simply combining the accumulated knowledge but also by continuously creating new knowledge (knowledge creation).

Additionally, the implementation of the knowledge management system improves the potential to learn and the potential to respond to changes, contributing to the sustainable growth.

This Guidelines aims to "share and utilize knowledge related to ship operations management and create new knowledge for the reinforcement of resilience and achievement of the safe operation." As the technology relevant to the ship's safe operation has been rapidly advancing with the development of the society's information level, it is required not only to adapt to the latest technology but also to comply with many rules and regulations for the environmental preservation. Therefore, it is critical that knowledge is shared across onshore and offshore teams and managed appropriately.

The volume of knowledge and experience the individual can acquire is limited, but sharing the personal knowledge enhances knowledge of the individual and the entire organization both in quantity and quality, and enables to achieve the safer operation management. Learning in advance and flexibility in accordance with the circumstances are necessary to make knowledge the source of power and to perform resilience based on the knowledge management. Building the environment where the vast amount of knowledge owned by the individual and the organization is managed and utilized as "knowledge that can be easily accessed by anyone at any time" leads to the achievement of the further safe operation.

5.1.2 Current status and challenges of knowledge management

Many companies have already been managing knowledge, whether in digital or analog, such as by accumulating operation records and constructing a database of incidents. However, there are quite a few cases of merely "preparing a box to store information."

Furthermore, a feeling that "I don't want to share the hard-earned knowledge and know-how with others" may arise as a psychological barrier in knowledge management.

The important theme in knowledge management is to overcome these challenges and to create new knowledge through the management and utilization of knowledge.

5.2 Process of knowledge management

5.2.1 Categorization of knowledge

Knowledge management addresses all of the "intellectual asset," which is categorized into data, information, knowledge and wisdom, and any elements referred to in ship operations management fall under its scope. (See Table 6 and Figure 4)

Table 6 Scope of knowledge management[6]

Data	Facts and quantitative numbers. Statistical values and indexes, representing the status of a given moment. e.g. operation data (speed, fuel consumption), the number of malfunctions
Information	Something obtained by sorting out and processing data to convey certain intention. e.g. graph of operation data or the number of malfunctions organized in time series or by sea area or ship type, etc.
Knowledge	Something with data analysis and observation added. Serving as materials to generate values. e.g. incident investigation reports, operation analysis, project reports, manuals.
Wisdom	Ability to create something through actions by using the skills in application and adaptability backed by knowledge, and the outcomes of the ability

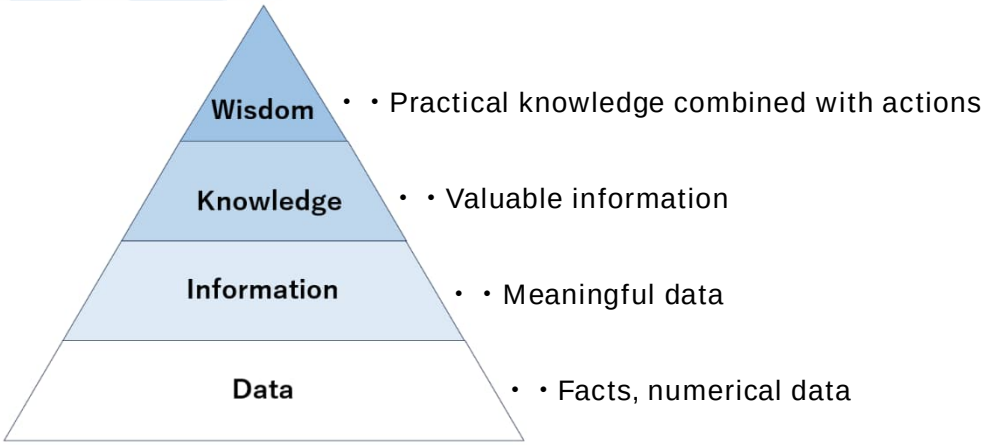


Figure 4 Data, information, knowledge, and wisdom[7]

[6] Reference 7) p37
[7] Reference 7) p37

5.2.2 Tacit knowledge and explicit knowledge

The "SECI model" proposed by Dr. Ikujiro Nonaka in the 1990s is widely known as the process of knowledge management. This model classifies knowledge into "tacit knowledge (knowledge based on personal experience and senses that cannot be easily articulated)" and "explicit knowledge (knowledge that can be expressed in words, diagrams, data and other means)," and indicates four processes to manage and utilize them.

(1) Socialization: Conversion from tacit knowledge to tacit knowledge

Process of transferring tacit knowledge of the individual to others by joint practice and observation.

Knowledge is passed down from one to the other through words, experiences and imitation.

(2) Externalization: Conversion from tacit knowledge to explicit knowledge

Process of articulating tacit knowledge of the individual in words or diagrams to enable it to be shared with others in an understandable way.

Documenting knowledge and experiences as notes and manuals to be shared among groups falls under this category.

(3) Combination: Conversion from explicit knowledge to explicit knowledge

Process of collecting, combining and organizing multiple pieces of explicit knowledge to create new knowledge. Existing explicit knowledge owned by the individual and the group in a form of notes and manuals is shared and combined across the organization to gain new knowledge.

(4) Internalization: Conversion from explicit knowledge to tacit knowledge

Process of learning and practicing the externalized and combined explicit knowledge to make it part of tacit knowledge of the individual.

Mastering learnings from the manuals through the actual operation falls under this category.

The circulation of these four processes enables each piece of tacit knowledge of the individual to be combined into explicit knowledge among the organization and internalized by the individual as new tacit knowledge. Knowledge of the whole organization continuously evolves and expands through the iteration of the cycle. The SECI model provides the platform to share and organize knowledge and to create new knowledge, which forms the foundation of the knowledge management system. (See Figure 5)

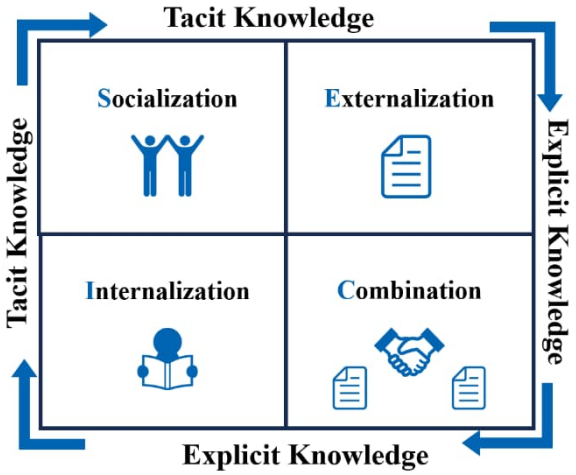


Figure 5 Conceptual diagram of the SECI model[1]

5.3 Development of knowledge management system

Development of the knowledge management system based on each process of the SECI model needs the performance requirements to realize the following objectives and necessary functions. Knowledge management system becomes viable by satisfying these requirements.

5.3.1 Objectives

The objectives of the knowledge management system is to collect knowledge owned by the individual and the organization and to accumulate them in an identifiable manner so that the environment where all personnel including seafarers can share the accumulated knowledge from anywhere at any time is developed.

Not simply sharing and utilizing knowledge but also creating new knowledge and developing a cycle for its identification and accumulation are also part of the objectives.

5.3.2 Functional requirements and performance requirements for the objectives (See Figure 6)

Functional requirement 1 **Effective accumulation and storage of knowledge is to be easily achieved.**

Performance requirement

1-1 Definition of knowledge
(e.g. experiences, insights, case studies of incidents, improvement cases, best practices)

1-2 Decision on the tools and methods for input and storage to facilitate the accumulation (e.g. forms, digital tools)

1-3 Provision of opportunities for the effective accumulation

(e.g. hosting of regular events, such as a knowledge exchange session)

Functional requirement 2 **Accumulated knowledge is to be safely stored.**

Performance requirement

2-1 **Tool with security functions to secure confidentiality**
Making it accessible only to the authorized person. Access authority to information is to be controlled.

2-2 **Restriction of authority to input, save and edit information to secure integrity**
Information is to be kept accurate without tampering nor exaggeration/omission.

2-3 **Securing availability**
The system is to be operated so that it is available at any time.

Functional requirement 3 **All personnel and organizations are to be able to access and utilize knowledge when needed.**

Performance requirement

3-1 **Knowledge is to be accessible from anywhere when needed.**

Functional requirement 4 **Opportunity is to be provided to utilize the accumulated knowledge.**

Performance requirement

4-1 **Understanding the needs of knowledge and identification of the usage frequency, effective reinforcement of knowledge**

4-2 **Communication of good cases gained by utilizing knowledge across the organization**

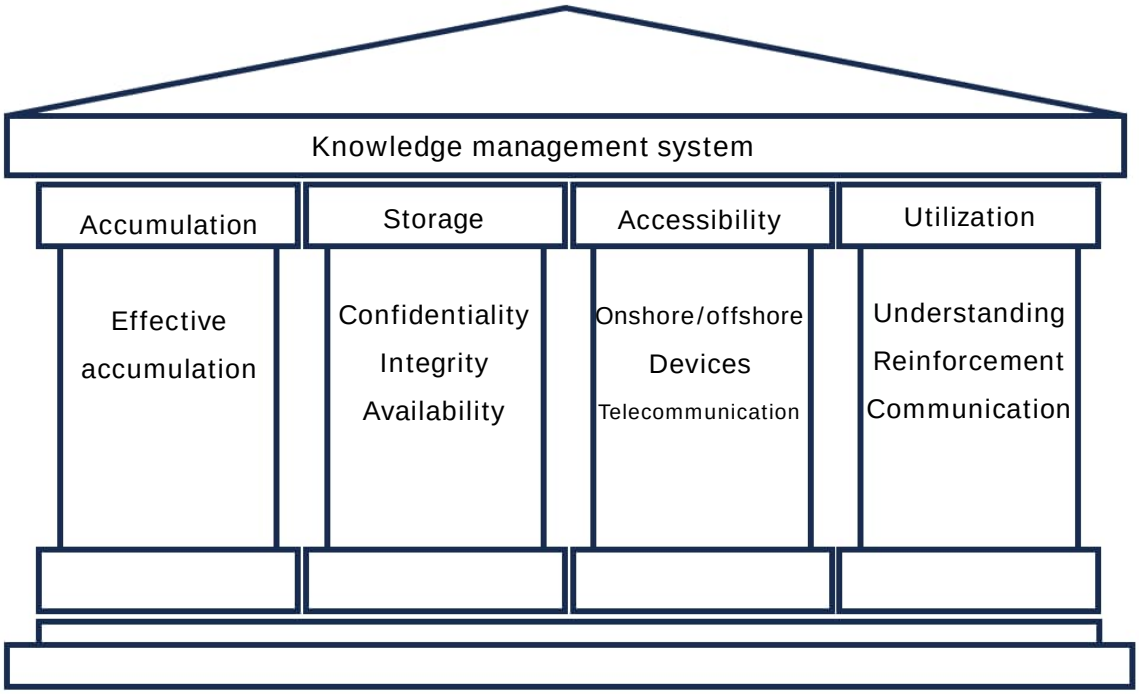


Figure 6 Functional and performance requirements of knowledge management system

5.4 Collection of knowledge

There is a wide variety of knowledge to be collected, including experiences, insights, case studies of incidents, improvement cases, and best practices. As such, it is important to clearly define knowledge to be collected and select the collection methods suitable for each knowledge (e.g. reference materials, literature researches, interviews, field surveys).

The amount of relevant information is bulky in case of long-standing or large scale companies, which may hamper the development of systems.

Collection of knowledge may be considered as additional workload due to difficulty in recognizing the benefits of knowledge utilization during the initial phase of system development, which also could become an obstacle.

Furthermore, the feeling of unwillingness to share the individual know-how with others could stand in the way of collaboration within the organization toward system development.

Given the above points, starting small could be an option with the limited knowledge collection or application (division-wise or ship-wise, etc.) in the initial phase of system development.

5.5 Utilization of IT and digital tools

Tools to operate the systems are to be well selected and prepared. The amount of information to be handled in the knowledge collection, even if started small, becomes bloated as its utilization progresses,

followed by the expansion of the targeted knowledge and the collection range that further increases the volume. In this regard, the digitalization of knowledge and utilization of IT tools are essential to effectively manage the vast amount of knowledge.

IT technologies including satellite communications are to be appropriately introduced and utilized to make the most of the knowledge management system between the onshore and offshore teams.

5.6 Strategy for digital storage of knowledge

Where to store and how to utilize the shared knowledge are to be carefully considered with the operability, maintainability, and security taken into account. As the utilization of IT and digital technology is indispensable, appropriate systems are to be selected.

It is important to adopt the suitable management methods in accordance with the user organizations or ships, the volume of knowledge to be stored, access methods, frequency of use, etc. Consideration is also to be given to the stability and speed of connection and the actual system usage status.

Ensuring the information security is an extremely important element, in addition to the knowledge accumulation. Knowledge may contain highly confidential information, such as personnel information related to competency appraisal, to which the access is to be appropriately limited. Especially when permitting the access to the knowledge management system from the outside of the organization, the user identification and control are one of the significant challenges.

Appropriate designation of accessible layers and authorities corresponding to the type of knowledge achieves the optimization of management works, enabling the access to necessary information while securing the information with restricted accessibility. Suitable security measures, including authentication processes and periodic password changes, are to be taken to enforce the proper access control both internally and externally.

Long-term storage of knowledge requires consideration from both physical and quality aspects. Physical aspect means the selection of recording media and their maintenance, while quality aspect refers to the establishment of storage policy corresponding to the storage period and frequency of access to specify the storage period and priority in storage.

5.7 Knowledge evaluation

Maintenance of the knowledge management system requires various resources, such as people, time and money. In order to achieve the effective and efficient maintenance of the system with the limited resources, the accumulated knowledge is to be evaluated in terms of its quality, frequency of update and usage rate, based on which knowledge to utilize is identified and the resources are concentrated in it.

(See Table 7)

Table 7 Example of items for knowledge evaluation

Evaluation item	Details of evaluation
Quality	• Whether the source of knowledge is clear • Whether knowledge is backed by technical or experiential evidence • Whether knowledge is understandable to users
Frequency of update	• Whether knowledge is regularly updated, as necessary • Whether knowledge appropriately addresses the introduction of new technologies and the revision of rules
Usage rate	• Access frequency by users • User's satisfaction level

Value of knowledge is evaluated based on whether the user recognizes it as "helpful" or not. Therefore, it is important to monitor the evaluation in a timely manner and enrich knowledge as necessary. With this, the knowledge management system is expected to be more utilized and the knowledge sharing within the organization will be vitalized, ultimately leading to the promotion of knowledge creation and the reinforcement of resilience of the entire organization.

Utilization of digital tools, such as showing in a graph how many times each knowledge has been searched and satisfaction level with the result, enables to visualize the realm of knowledge (a content hole), representing the knowledge in high demand but not serving the required purpose. By identifying the realm of knowledge that needs intensive reinforcement in this way and allocating the necessary resources in it, the knowledge management system will be effectively operated and continuously improved. (See Figure 7)

Meanwhile, it should be noted that making a premature decision on the necessity of knowledge could be dangerous from the viewpoint of the ship's safe operation, even if the knowledge has little demand. Knowledge related to the response against emergencies including fire and stranding and preventive measures is to be considered as indispensable in the ship's safe operation even though not frequently used in normal times, and thus such knowledge should be treated carefully.

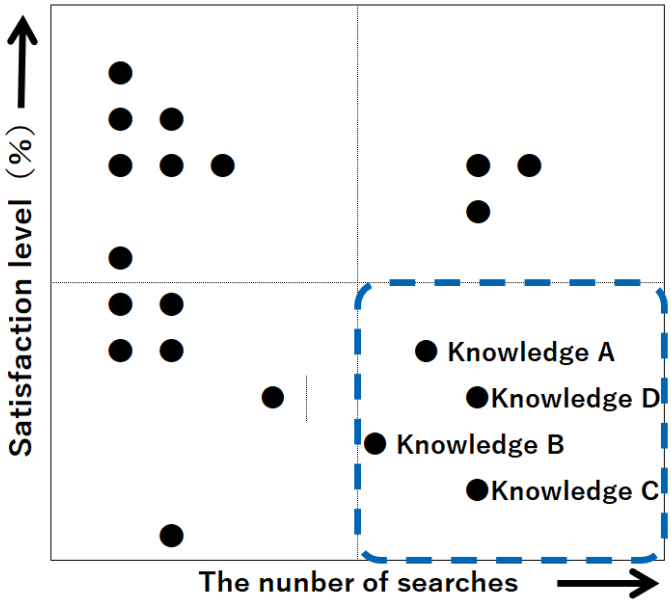


Figure 7 Content hole (Conceptual diagram)

5.8 Strategic utilization of knowledge

The success of the knowledge management system depends on how well the database is utilized, where the accumulated knowledge is systematically compiled. There is a case where the system is developed but not fully utilized, so the causes and solutions are provided as follows.

(1) "Lack of understanding of the knowledge management system"

If the benefits of utilizing knowledge (e.g. creation of new knowledge, improved operational efficiency, reduced work hours) are not fully understood, only the system development jumps ahead, while the accumulation and management of knowledge are deemed as additional workload. Unwillingness to disclose know-how to others could be another obstacle in utilizing the system.

It is important to assign a dedicated personnel for the system development project so that the necessity and effectiveness of the system are thoroughly explained within the organization based on the SECI model from the initial phase of system development to build a consensus among the relevant members of the organization.

(2) Situation where "tasks can be fulfilled even without utilizing the knowledge database"

Incorporating the knowledge database (knowledge base) into work processes promotes its utilization.

Example:

- To review failures that occurred during the similar work in the past or good practices marked as a key point for the work, taking the opportunity of the daily TBM (Tool Box Meeting) before starting the work of the day.
- To extract cases of incidents and responses against them from the knowledge base and review them during trainings.

These reviews provide insights through the comparison with the actual works, serving as an opportunity to create new knowledge. When incorporating these reviews into work processes, it is important to keep a record of the outcomes for the further knowledge accumulation. It is also necessary to promote the automation to the extent feasible so that the newly introduced process would not be recognized as burden, and to periodically review the output to verify the effectiveness.

(3) Frequency of usage is lowering with a feeling that "the knowledge base is useless"

If the accumulated knowledge is outdated and the user cannot access the appropriate knowledge in time of need, the user may negatively evaluate the knowledge management system. In this case, the utilization of the system and the creation of new knowledge based on the accumulated knowledge are unlikely to happen.

While updating knowledge in a timely manner is required as a solution, immediate update of the vast amount of knowledge is impractical due to human resource and time constraints. Therefore, identifying the realm of knowledge in high demand based on the number of searches for each knowledge and updating the realm in a concentrated manner are effective. Setting up evaluation criteria for the system and incorporating them into the system further encourages the user to utilize the system while evaluating it, resulting in the knowledge base growing independently.

5.9 Cases of failures of the knowledge management system

This section provides the typical cases of failures in the operation of the knowledge system management.

(1) Siloed knowledge

This represents the situation where each location (division or ship) works independently and accumulates knowledge but does not share the knowledge each other, just like a single type of grain being stored in a silo and unloaded only from one location at its bottom. With the limited access to knowledge, the combination of knowledge to create new knowledge is not promoted.

(2) Treasure hunting

This represents the situation where knowledge is accumulated disorderly without evaluation, and thus the user has to grope for the necessary knowledge from a mix of good and bad as if it were a treasure hunting game. The user consequently is unable to find out the necessary knowledge in time of need and unutilized knowledge keeps on piling up, which results in the negative evaluation of the entire system.

(3) Knowledge monopolization

This represents the situation where knowledge is monopolized by an individual and not widely accumulated or shared among the entire organization. An individual is naturally tempted to have his/her own knowledge all to him/herself, and this tendency is particularly evident when it takes considerable costs and time to acquire knowledge.

A possible solution to this challenge is the introduction of a system to fairly evaluate the contribution to the knowledge management system for promotion of the knowledge sharing.

5.10 Reinforcement of resilience by the knowledge management system

Establishment and effective operation of the knowledge management system promote the creation of new knowledge and reinforce not only the potential to learn and the potential to respond but also the potential to anticipate. Eventually, resilience is reinforced, which greatly contributes to the achievement of the safe operation.

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Acknowledgments

We would like to express our sincerest appreciations to Dr. Kitamura, Professor Emeritus at Tohoku University, and Dr. Takahashi, Professor at Tohoku University, for their significant guidance for the development of this Guidelines.

Our utmost gratitude also goes to Capt. Terje Lovoy for introducing the methods to restructure the SMS as well as for providing highly valuable insights for identification of challenges and consideration of future improvements.

We are taking this opportunity to gratefully acknowledge all the support we have received.

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Dr. Makoto Takahashi	Professor, Tohoku University
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Appendix 1 Behavioral Competency

It is known that the causes of past maritime incidents are mainly human errors and lack of communication, and thus, the STCW Convention refers to the importance of non-technical skills such as leadership, management skills, decision-making ability, teamwork and communication capabilities.

The tanker industry is also aware that non-technical skills deserve more attention. As such, OCIMF[1] and INTERTANKO[2] issued the Guidelines on the assessment and verification of non-technical competencies such as seafarers' behavior and attitude, titled "Behavioural Competency Assessment and Verification for Vessel Operators" based on the insights about handling and carriage of petroleum products and terminal management.

The Guidelines explains competency domains and elements to be assessed, behavioral indicators for each of them and assessment methods (preparation, conduct of assessment, determination of the assessment outcomes) as well as assessor training. The Guidelines also argues that the assessment of these competencies not only contributes to the identification of areas to be improved and planning of corresponding trainings but also to promotion and recruitment processes.

1 OCIMF (Oil Companies International Marine Forum)

2 INTERTANCO (International Association of Independent Tanker Owners)

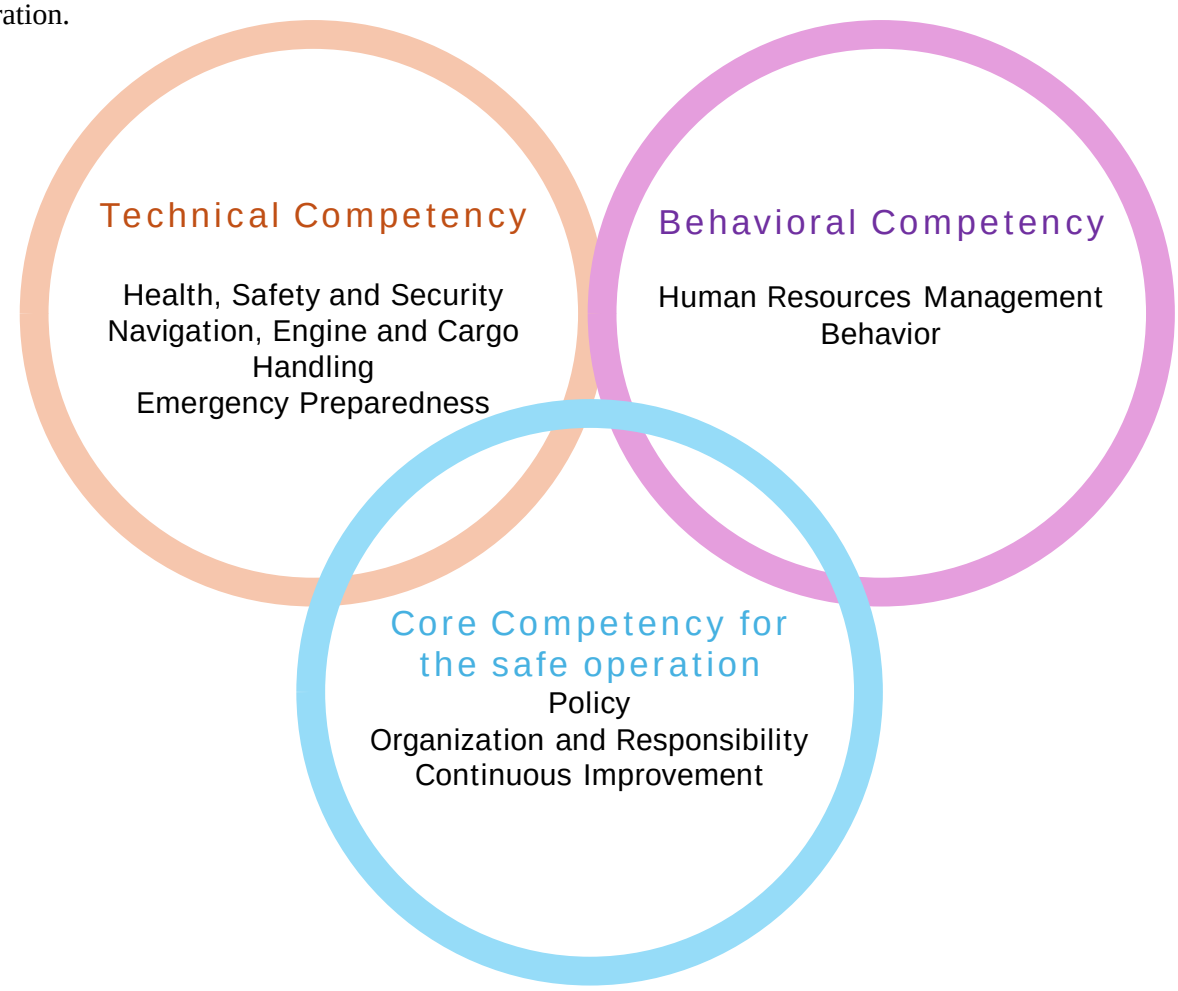
Appendix 2
ClassNK Maritime Competency Framework

More than 20 years have passed since the adoption of the ISM Code, and now that the continuous improvement by the SMS as well as the risk-based effective management methods have widely spread. While the occurrence of large-scale marine accidents and pollutions is decreasing these days, its decrement is leveling off.

Further, new knowledge and competencies are required as represented by the introduction of EEXI (Energy Efficiency Existing Ship Index) and CII (Carbon Intensity Indicator) as well as by the spread of alternative fuel vessels, which constantly increases the ship management tasks and burden on the seafarer.

Against such a backdrop and requests from the industry, ClassNK aims to further contribute to the safe and effective ship management through a proposal to explore the fusion of Behavior approach and Competency management approach, which are being implemented in the industrial safety field, along with the conventional ship management by the SMS.

Specifically, ClassNK proposes the "ClassNK Maritime Competency Framework," consisting of the conventional Technical Competency combined with the Core Competency required for the ship management business and the Behavioral Competency covering essential behaviors to achieve the safe operation.



Technical Competency

This section covers the technical competencies companies, onshore personnel and seafarers are to acquire to ensure the ship's safe operation. Necessary education and training are identified by clarifying the competencies required for each workplace and job grade. Further, both onshore/offshore personnel may find it beneficial for their career development to refer to the competencies required for different workplaces or the higher positions.

Health, Safety and Security

Safety control and management

It is necessary to manage the safety of the working environment, situation and operation process as well as the identified hazardous jobs and specific works. This requires the ability to understand the specific methods and procedures including the reasons and background and to steadily fulfill them (or have them fulfilled). Resilience is also important, meaning to be capable of taking actions suitable to the situation without yielding to other external factors and commercial pressure.

Risk assessment and management

It is deemed to be essential for an organization to manage the risk associated with the condition and situation to avoid or mitigate an accident. Ability to accurately assess the risk associated with the condition and operation and to consider the possible countermeasures in a concrete manner to mitigate the risk to the acceptable level is required. This ability is to be exerted at the appropriate timing, and the subsequent verification is also to be addressed.

Change management

Assuming the risk associated with each change in advance to implement the corresponding countermeasures and reducing the risk of loss, defect, accident and failure caused by the change are necessary as a part of risk management. This applies not only to the tangible element such as the equipment and the vessel's body but also to the intangible side such as organizational restructuring. It is required to collect and assess information on the safety and impact before the change is made and to consider the alternative options as necessary, such as further changes or rollback.

Maritime cybersecurity

Competency to take actions with knowledge of security measures required in each workplace or onboard is necessary. In addition to the understanding of the ship security plan for the company's own ship, measures to collect information on the security threats expected in the ship's navigation area, security risk management, and actual actions against the threats are required. Similarly, knowledge and the ability to deal with cybersecurity are also required.

Navigation, Engine and Cargo Handling

Understanding of the stakeholders

Onshore personnel, captain and seafarers are to properly understand the relationships among the business stakeholders (shipowner, ship, charterer, etc.) and to take appropriate actions for the ship's operation. It is required to have the competency to properly differentiate the matters attributed to the shipowner and those to the charterer based on each situation and event to pay due consideration and act accordingly for the internal/external teams, clients and the related parties.

Navigation

Ensuring watchkeeping by the captain and deck department officers and ratings is one of the most important competencies. In addition to the maintenance and handover of the general watchkeeping, knowledge, consideration and action are required based on the ship's condition, the weather and sea states, congestion with surrounding ships and various special navigations.

Engine

Ensuring watchkeeping by the chief engineer and engine department officers and ratings is one of the most important competencies. In addition to the management of each equipment and consideration for individual characteristics as has been done, knowledge and the ability to handle new equipment are required for electronically controlled main engines, SCRs, ballast water treatment systems, etc.

Port call and cargo handling

Maintenance of deck equipment on the ship in port includes the monitoring of mooring and anchorage status, cargo handling management, operation of cargo handling equipment and refueling. Consideration and competency equivalent to those during the voyage are required for the ship's safety management even in port.

Electric and electronic equipment

With the increase in the electric and electronic equipment onboard, the ability to manage and operate the electric and electronic equipment/auxiliary machine is becoming important. Knowledge, technique and capability related to high voltage switchboard is especially considered to be essential for the recent large ships.

Environment protection

Environment protection is increasingly gaining attention in the shipping industry, which has made the relevant knowledge and competency essential for business and management of the ship's safe operation. In addition to the conventional control of oil pollution, bilge, ballast water, waste and sewage, fuel efficiency and rating system are to be understood and thoroughly implemented.

Radio communication

Radio watchkeeping as well as the management and operation of radio equipment is the competency required both for deck and engine departments. With the increase of IT and communication equipment, it is becoming more likely that their failures may directly compromise the ship's safe operation. Knowledge and the capability to deal with the technologies and equipment with the understanding of the recent trend are indispensable.

Document and record management

Developing and implementing the procedures to identify and manage documents and records are the required competency not only to secure the objective evidence for the safe operation management activity but also to ensure the continuous improvement. With DX and the advancement of IT technologies, big data is to be managed in addition to the conventional document records.

Operation and Maintenance

Maintenance

Maintenance of the vessel's body and equipment is a basic competency required for onshore personnel and seafarers. It is to be noted that this not only contributes to the management of the immediate safe operation but also brings business profits such as the improved trustability and longer life limit of the ship. This competency includes the planning of maintenance, failure response, and recording.

Maintenance of critical equipment

As stipulated in the ISM Code, critical equipment that directly leads to the blockage of the ship's safe operation is to be identified and specially addressed for the betterment of its trustability and maintenance, which is considered to be a part of the ship's regular maintenance activities. Consideration is also to be paid for the equipment not used normally.

Emergency response and preparedness

Identification, procedures and resilience

All emergencies the ship in operation may encounter are to be identified and addressed in accordance with the proper procedures. In addition to the identification and emergency response, competency to act flexibly based on the situation (i.e. resilience) is also required.

Reporting and communication

It is to be recognized that the lack of communication is a significant defect that may cause serious marine casualties and incidents. Identification, establishment and implementation of the communication methods between the onshore/offshore personnel as well as among the departments through reporting and correspondence are the competency required for all the personnel.

Drill and training

Appropriate response to emergencies requires the permeation of the procedures and countermeasures through the repetitive training and education for the onshore personnel and seafarers in normal times. Necessary training and education are identified by referring to the case examples of the safety management system updates and the actual incidents.

Core Competency for the Safe Operation

This section compiles the competencies common to both onshore and offshore personnel and important for the ship management company, including policy, safety culture cultivation, and compliance.

Policy

Company vision, mission, value and policy

It is necessary to set a long-term goal as a company to clearly define the mission to be fulfilled in the future. Values to be demonstrated by the personnel are the “behavior and attitude” to achieve the goal and the mission, which embodies the competency shown in this framework. Guidelines (policies) are set up in a concrete manner based on the above.

Safety Culture

Safety culture is a collection of belief, awareness and value about the safety against the internal risks, which is shared by the employees. This can be promoted through the commitment of the senior management to the safety and the continuous learning involving the entire organization. Competency corresponding to each job position is required to cultivate the safety culture.

Organization and Responsibility

Organization and authority

Competency required here is to establish, manage, and operate the organization for the safe operation management. Capability to make an organizational approach to clients and external stakeholders as business is also sought.

Responsibility and accountability of the onshore personnel

Onshore personnel is given with the authority corresponding to their roles to fulfill their duties and the safe operation management, and they bear accountability and responsibility, which are to be clearly defined by the company. Onshore personnel is also to understand the above properly and to have the competency to fulfill it for the seafarers and external parties.

Responsibility and accountability of the shipboard personnel

Shipboard personnel bears the authority and responsibility corresponding to their job grade, in the same way as the onshore personnel. All crews are required to have the understanding of the above and the competency to ensure their fulfillment. While overriding authority is granted to the captain, it is to be exerted with accountability.

(IMO) International Conventions

Safe navigation is realized by the compliance with the laws and regulations. International conventions are the basis of the operation of oceangoing vessels. All the personnel of the company are to understand them and prioritize the compliance with them.

Flag rules and ship classification

All ships are to be registered to a flag state and their operation is subject to the flag state’s jurisdiction. International conventions are interpreted by each flag state and incorporated into their national rules. Therefore, it is required to fully understand the rules of the ship’s flag state.

(Local) Laws and regulations

Authority exercised by a port state over ships engaging in international voyage, which is widely known as PSC activity, is stipulated by the United Nations Convention of the Law of the Sea, the SOLAS and many other conventions. In addition to the international conventions and the flag state’s rules, understanding the port state’s laws and regulations and ensuring the compliance with them are also the important competency for onshore and shipboard personnel.

Other guidelines

IMO, Flag Administrations, classification societies and various maritime organizations issue a variety of guidelines and standards as their recommendations in addition to the rules. These recommendations are based on the past repeated maritime incidents and disasters as well as the learnings from them. Onshore and shipboard personnel are to respect these recommendations and comply with them as much as practicable, in the same way as they do for the rules.

Continuous Improvement

System evaluation and review

Continuous improvement is essential for the safe operation management. The first step toward the improvement is to evaluate the status quo in all aspects, including planning, organization, procedures and their implementation. Competency related to the establishment of the evaluation criteria and methods as well as their implementation is required.

Internal audit and inspection

Many companies are conducting various internal audits and inspections, which are also necessary for the safe operation management. Such activities lead to the cultivation of competencies, such as documentation, understanding of on-site situation and compliance, which are necessary for the internal auditors/inspectors and those who undergo the audits/inspections.

External audit and inspection

Second and third party inspections as well as external inspections directly measure the company's performance and they are deemed important not only for the safe operation management but also for the entire business. It is required to have a good understanding of external audits/inspections and to take actions to them appropriately in order to earn a fair evaluation.

NC and defect management

Identification of exact causes of non-conformities and defects and implementation of the corresponding measures to prevent recurrence are the essential elements for the continuous improvement. Understanding of the specific measures and capability to develop and implement the processes are required.

Behavioral Competency

This section compiles the behaviors necessary to maintain the good workplace and onboard environment and to achieve the safe operation. Building good relationships and working environment is the basis of everything, and thus it is desirable to pay due considerations to these competencies regardless of job grade, job type, age and nationality.

Behavior

Communication

Maintaining effective communication is the basis of all behaviors. As a matter of course, communication is realized only when there is someone to communicate with, and thus it is to be considered interactively. Competency to constantly build a relationship of trust with all the relevant parties is required, not just superficial techniques.

Leadership and teamwork

Different leadership styles are required for each job grade both onshore/offshore in each phase of the ship's safe operation management, such as planning, operating, evaluating and correcting. Teamwork including the leader is also necessary to achieve effective and high-level performance. Specific competencies required for leadership and teamwork are to be clarified.

Innovation and creativity

Innovative and creative approach is also one of the necessary competencies. Effective business approach incorporating new technologies and trends is to be sought. It is the competency that all employees should acquire to make the most of an opportunity, regardless of job grade or job type.

Problem-solving and decision-making

Clearly defining the problem and exploring solutions are the important competency for onshore/shipboard personnel. With a variety of problems, such as a conflict of opinions from a technical or business viewpoint, it is required to consider the options for solutions and to make appropriate decisions in accordance with the environment and situation.

Diversity and inclusion

People with various nationalities, cultures and values are working in the shipping industry and this is nothing new. However, with the recent rapid globalization, there has been a renewed focus on the mindset for awareness, acceptance and utilization of diversity. Cultivation of the sense of unity as an organization is expected to bring the higher performance.

Self motivation

Motivation is necessary to pursue the goal and fulfill the duties. What is referred here is the competency to drive the confidence to entice the actions. It is recommended to learn specifically how to boost motivation, whether intrinsic or extrinsic.

Human Resource Management

Qualification and appraisal

Acquisition and management of qualifications and capabilities required for the safe operation are critical for the shipping industry. Identification of the qualification and capability corresponding to the types of ships and operations for the ships managed by the company is necessary, though not limited to those required by regulations. Both onshore and shipboard personnel are to acquire the necessary qualifications and capabilities respectively. Competency to identify, manage, acquire such qualifications and capabilities, or have them acquired, is required.

Recruitment and assignment

Talent mismatch causes the lowered efficiency not only of the person in question but also of the organization. Required skills are to be clearly defined when recruiting or assigning personnel. A set of competencies in this framework may be incorporated into the processes of recruitment, assignment and promotion.

Talent development

Talent development brings benefits to the company and also motivates the personnel, and thus, this is an important element as much as recruitment. It is necessary to identify the skills to be developed, establish the processes and ensure their implementation.

Task management

Sustainable development of business and safe operation management is unlikely to happen if exhausted employees are overlooked. Managers are to acquire the competency to accurately identify and assess each task in terms of its necessity, workload, time constraints, suitable personnel and required skills, for the purpose of management. Staff is to keep precise records of the task progress and report it to the manager.

Appendix 3 Simple SMS and Lovoy Method

In the process of developing the guidelines, we sought insights from Mr. Terje Lovoy regarding the simplification of manuals. Mr. Lovy is one of the pioneers who first introduced the concept of "manual simplification" to the maritime industry. With 27 years of experience in the aviation industry, he has contributed to enhancing safety at Boeing and major airlines by utilizing functional procedures. Rather than directly applying case studies from the aviation industry, he established the "Lovoy Method" through extensive trial and error and adapted it to the maritime sector.

As one approach to creating simplified manuals, we introduce Mr. Lovoy's explanation of the Lovoy-Method.

The Need for Effective Manuals

Since 1989, the ISM Code called for a Safety Management System (SMS) aimed at managing ship safety systematically in response to repeated maritime accidents. SMSs have improved safety in the shipping industry, but they also introduced new challenges.

The Story Behind this Guidance and Its Goals

ClassNK and Lovoy Training Inc., parties agreed that overly complex SMSs pose challenges but also present opportunities for improvement.

A user-friendly SMS is good for safety and efficiency.

It is easier to use onboard, in the office, and during audits.

It also makes it easier to keep SMSs up to date and prepare for audits.

This guidance recommends how to simplify and improve your SMS for increased safety and efficiency.

We will discuss the process, benefits, and risks.

Learning from Aviation's Success with Simplicity

Since the late 1950s, the aviation industry has reduced accident rates by over 100%.

This remarkable achievement has drawn interest from other industries, including shipping, which seeks to learn from aviation's success.

Initial safety gains came from technical improvements.

However, human error, responsible for up to 80% of accidents, remained a major issue. Focusing on the human element further lowered accident rates to today's low levels.

The International Civil Aviation Organization (ICAO) is aviation's version of the International Maritime Organization (IMO). ICAO published standards similar to the ISM Code, and these standards also added excessive complexity.

In the old days, pilots saw checklists as a nuisance. The checklists were overly complicated, blending trivial and "killer" items. Some experienced pilots even dismissed them as "checklists for dummies."

Pilots often read them not because they wanted to, but because they had to. They were more concerned with the cockpit voice recorder. As a result, they read them quickly and superficially rather than carefully checking each item. This checklist complacency contributed to accidents like Delta Airlines Flight 1141 in 1988. After several similar accidents, the industry examined checklist complacency.
The first checklists in the late 1930s, marked the shift from no checklists to increasingly complex ones. By the late 1990s, these checklists had become so complicated that they interfered with safety, common sense, and good airmanship. This prompted the industry to focus on simplifying procedures and checklists without losing facts. This approach proved to be highly effective.
Today, pilots read checklists slowly and carefully—not because they have to, but because they want to. They recognize checklists as valuable tools.

In 2009, Terje Lovoy was one of the first to introduce the concept of SMS simplification to the shipping industry, a revolutionary idea at the time. He went public with this issue through speaking, writing, and working with shipping companies to find solutions. Lovoy has 27 years of experience from aviation.
He worked for Boeing and major airlines that had made significant safety improvements through effective procedures. Lovoy understood that shipping companies could not just copy airline procedures. After extensive testing, they were able to modify some airline principles to fit the shipping industry. This ultimately led to the Lovoy Method for SMS simplification and improvement.
The goal was to make systems user-friendly to increase usage and reduce mistakes. Today, most shipping companies recognize that an overly complex SMS is a problem.

What Makes SMSs Too Complex?

There is usually a link between how well we understand problems we are trying to improve and the results. It is therefore worth spending some time discussing why SMSs often become overly complex. Lovoy's team analyzed 63 SMSs over a decade, many containing about half a million words. A survey of over 1,000 seafarers revealed common issues:

- Difficulty locating information
- Instructions that do not follow workflows
- Spaghetti mixing of explanations and tasks duplicated in several places
- Difficult words, too long, and passive sentences

Root Causes Analysis

Many shipping and marine insurance companies engaged Lovoy for root cause analysis of why SMSs become too complicated.
Initially, they found that failure to follow procedures was a common issue. Further investigation

revealed that many procedures were too complicated to use effectively. Some believed this complexity was intentional to pass audits.

But Lovoy discovered something else:
Writers only know how to write complicated text because that is what we learn in school. Digging deeper, it became clear that this complexity was not a deliberate strategy. It was a lack of strategy altogether.One of the root causes was the absence of writing standards, training, and ways to measure how user-friendly the SMS was. Contrary to common assumptions, Lovoy's research showed that the challenge was not information overload, but rather in how we present the information.
Unnecessary complexity stemmed from factors like duplications, contradictions, excessive cross-referencing, and poor SMS structure.
These findings highlight the crucial need for not only quantity but also quality and clarity in information presentation. To tackle these issues, Lovoy developed text simplification techniques to streamline processes, improve comprehension, and create more concise text without sacrificing accuracy.

The Power of Simplicity in Compliance

Surprisingly, many believe it is impossible to make a SMS that complies with audit standards and is user-friendly at the same time.
Lovoy followed 23 shipping companies who simplified and improved their SMSs using their own people. They simplified by washing out filler words, double talk, and changing from passive to active sentences. They used the Lovoy Text Washing Method to simplify without removing facts or dumbing down the text. They replaced overly complex words such as “elucidate” with more commonly used words such as “explain” or “make clear.”They continued using maritime terms such as “enclosed space,” “forecastle,” and other IMO standard marine phrases.
You can read more about text washing methods on https://lovoy.info/

Companies that successfully simplified their SMSs received positive feedback from seafarers with around 70% increased perceived usability. Second, companies performed better in audits because inspectors could see that the procedures matched real-life practices. In summary, the simplified and improved procedures better complied with the true intentions of regulations and guidance.
This led to new industry requirements for more user-friendly SMSs.

The Dangers of Oversimplification

Contrary to popular belief, the problem with overly complicated SMSs is not an overload of information. Many shipping companies and articles mistakenly focus on this, but Lovoy strongly

disagrees. Through their analysis, Lovoy found that the issue is not too much information but rather how SMSs present information.
For example, cargo ships need procedures with sufficient details to manage their cargo safely.
The challenge is to present this necessary information in a clear, concise manner without losing important facts.

Lovoy argues that a well-structured SMS should function as a reference tool, not as a book to be read from start to finish in one go. New users will initially read the entire system, but most use it to quickly look up specific information. With a logical structure, clear headings, and short, well-organized paragraphs, too much information ceases to be a problem. Like an encyclopedia, a SMS should allow users to find what they need quickly and efficiently.

Lovoy cautions against the misconception that simplifying a SMS means removing a lot of information. What is perceived as unnecessary information might be essential at some point. The old SMS reflects the company's collective experience. Therefore, a simplified SMS should improve safety and compliance without oversimplification. Lovoy warns that oversimplifying leads to loss of critical details, ultimately compromising the effectiveness.

Spaghetti SMS Structure

Lovoy found a bigger problem than overly complex text. They called it spaghetti SMS structure. This results from copying text blocks from codes and guidance without adapting them to real-life workflows.

How well we succeed with restructuring is an important success factor. Lovoy estimates that 80% of success comes from restructuring and 20% from text washing. One cause of spaghetti SMS structure is that many believe we should not mix guidance and mandatory actions. They split these into different sections, which forces seafarers to read multiple sections simultaneously.Too many sections covering the same topic result in excessive cross -referencing.

A better approach is to group related material in one process, following the user's workflow. The text should follow the footsteps of the person doing the job. Some steps are mandatory, and other are guidance. But the most user-friendly way is to keep them together in process-oriented procedures.We still need to clarify what is guidance and mandatory. The words we use tell the user if a step is mandatory or guidance.

- Shall is mandatory
- Should is a recommendation
- Consider indicates to use judgment and decide

The Big Picture SMS Structure

So far, we have focused on how to structure individual procedures. We discussed ensuring each one is clear, concise, and aligned with actual tasks.

However, a SMS is made up of many procedures and documents, each serving a specific purpose. The question now is, how do we approach the overall structure of the entire SMS? It is crucial to design a big-picture framework that organizes these elements effectively.
SMSs must comply with many standards, but each standard is different. Some companies believe that matching the structure of one standard will simplify audits. While it might seem smart to align with the structure of one standard, this leads to misalignment with the other standards. Most industry standards require a logical, process-oriented structure. They often use a sequential, building-block system to organize content, which helps in explaining requirements. However, this structure does not necessarily align with the actual processes of a shipping company.

It is crucial to recognize that while the standard's organization is useful for presenting information, it may not be the most practical for structuring real-life operations.
Instead, companies should extract relevant content from all standards and create a process-oriented system that better fits their operational needs.

Lovoy recommends not duplicating any one standard's structure. Instead, reorganize the SMS to follow the workflow of each job. This is a one-time effort. It makes the SMS easier to use, update, and ensures compliance with all relevant standards.

Effective Compliance Through Real-Life Alignment

To comply with standards, we must carefully extract relevant information and incorporate it into our procedures.
You might wonder how to do this effectively. The key is to ensure that written procedures closely match real-life practices. When procedures reflect actual work, they are more effective and easier to follow. This alignment reduces confusion, boosts efficiency, and improves safety. Closing the gap between written procedures and real-life practices strengthen compliance, reduce errors, and build trust.
Well-aligned procedures lead to better outcomes in everyday operations and audit results. Specific standards like SIRE and COSWOP now recommend logic user-centered procedures reflecting actual tasks. ISO 9001 requires process orientation. Many shipping companies with ISO 9001 approval fail to adapt it to real-life practices. However, it is possible to create a user-friendly, process-oriented SMS meeting all relevant standards.

Text Washing

The ISM Code requires SMSs written in a language that seafarers understand. As a result, most SMSs use English. However, many seafarers come from countries where English is not the first language. They speak different native languages. Therefore, it is crucial to use a form of English that is clear and understandable for most seafarers. For this reason, guidelines like TMSA3 call for the use of plain language. Plain language, as defined by various governments and laws, involves using simple, everyday words. This approach ensures that all seafarers, regardless of their background, can easily understand the procedures. Clear communication prevents misunderstandings, and improves safety and compliance.

To achieve this clarity, Lovoy developed a text washing technique. Text washing means to simplify difficult words, passive sentences, long sentences, and remove double talk and filler words. Filler words are words that add little value, such as “completely dead” or “round in shape.” The table below has text washing examples:

Before Text Washing	After Washing
Give consideration to	Consider
During the period of	During
On an hourly basis	Hourly
Give the recognition to	Recognize
Because of the fact that	Since
20 words	**5 words**

Common everyday words are easier to understand and quicker to read. As required by the ISM Code, use them as much as possible. Complex words take more time, even for native speakers. Lovoy published a free online dictionary at https://lovoy.info/dictionary/ . It lists simpler alternatives for typical complex words found in older SMSs.

Successful companies measure their results. Lovoy designed Key Performance Indicators (KPIs) to help writers meet targets. Some examples are Percent Passive Sentences (PPS) and Average Words per Sentence (AWS).

Who Should Rewrite the SMS?

The main risk with SMS simplification is not choosing the right method. This often results in over-simplification. Another risk involves opting for a quick fix by hiring external consultants rather than investing in your own staff. Outsourcing to external consultants may seem like a convenient solution, but it is often a temporary fix. Consultants may lack an in-depth understanding of your company’s specific needs and operational realities. This can result in a SMS not fitting your actual practices, potentially leading to further complications and inefficiencies.

Investing in your own staff for SMS simplification ensures a more tailored approach. Your team, being familiar with the company's day-to-day operations, creates procedures reflecting real-life practices. This approach not only promotes long-term improvements but also builds internal expertise that prevents the recurrence of previous complexities. Involving your staff in the process fosters a deeper understanding and ownership of the SMS.

This leads to more effective implementation and adherence to the procedures. Internal writers allow for continuing adjustments and improvements, enhancing the system's effectiveness over time. Choosing to develop internal capabilities rather than external consultants is a longer-term solution. It ensures that the changes made truly reflect your company's needs. It supports continuous improvement and adaptation. This customization is evident to auditors and clients, providing a competitive edge in the market. Investing in your own team is low risk and usually far outweigh any short-term extra costs. It will reduce costs in the long run.

The Advantages of Using Subject Experts in Writing

Should companies use a writer with good English writing skills but little knowledge of the content, or should they use a subject expert? Lovoy tested both options and found that:

- True simplicity comes from thorough understanding.
- People without a good understanding of a subject often insist on unnecessary complexity.
- Simplification without understanding is difficult.

Based on this, Lovoy decided to test if they could train seafarers and internal staff to write good SMS procedures. Today, most seafarers come from countries where English is not the native language. Lovoy decided to include what language scientists call a controlled language in the Lovoy Method. It is English but with strict rules for grammar, vocabulary, layout, and structure. When used correctly, it reduces complexity without losing facts. It makes it easier for both native and non-native English speakers to write user-friendly procedures.

Global SMS Writer Training for Seafarers and Office Staff

Lovoy also designed an online training program to train seafarers to become SMS writers. They tested it with seafarers and office staff in different parts of the world. With training and practice, most writers produced high-quality procedures. They got good results from non-native English-speaking nations. The controlled language allowed shipping companies to use their own people to reduce large volumes of complicated, inconsistent text to clear, easy-to-use text.

Is Switching to New Software the Solution?

Some believe that switching to new software for the SMS is a miracle fix for all their previous difficulties. They think that simply transferring old text into a new electronic format will solve the problem. However, the saying “garbage in, garbage out” applies here. If the content is flawed, moving it to a new system will not fix the issues.

Seafarers often give feedback that it was hard to find information in the old SMS. After moving to new software, finding information became even more challenging. The real solution is to first address the content and then place it into a new system with a process structure matching real-life practices.

One common problem with many new electronic systems is that they have a fixed structure set by the manufacturer. This can force shipping companies to use a structure not matching their needs. Instead, new software often forces SMSs into a spaghetti, non-process-oriented structure. Shipping companies should first refine their SMS content and create a process-oriented structure before selecting a new electronic system. This approach ensures that the software supports their specific needs rather than forcing them into a structure created by software developers who may not fully understand the practical workflows of seafarers.

The Biggest Challenge

Simplifying a SMS is a strategic move that improves safety and audit results. Most DPAs recognize this, but convincing senior management can be challenging. Owners might assume simplifying the SMS is solely the DPA’s job. But it requires tools, training, methods, and time—resources that DPAs often lack. Investing in these areas is a one-time expense that offers long-term benefits.

In successful SMS simplification, one key factor stands out: The DPA was capable of clearly presenting the advantages of SMS simplification. This ability to make a strong case to senior management is often the most important factor in whether a company succeeds or fails. Many DPAs want to simplify but struggle to convince owners of its importance.

Therefore, DPAs should gather relevant information, examples from other companies, and insights from new audit standards. This helps show that continuing with a complex SMS poses more risk than making the proposed changes. Simplifying the SMS is not only a safety issue but also a way to give the company a competitive advantage. Audit standards increasingly focus on user-friendly SMSs, making this SMS simplification a priority in many shipping companies. Although it may be challenging and require courage, it is achievable and worthwhile. Building a strong case for SMS simplification is a key factor for success. A DPA who can make a convincing case to owners is therefore probably the most important SMS simplification success factor.

Conclusion

Simplification requires the right tools and knowledge. While it may seem less urgent compared to technical projects, it is crucial for reducing human error. Human error accounts for up to 80% of marine

losses. Simplifying SMSs can save time and money in the long run. Companies that simplify their SMS understand that safety and competitiveness go hand in hand.

References

SMS writers who want to learn more can find additional explanations, background information, articles, case studies, and videos on the website: https://lovoy.info/

Prime Shipmanagement Guidelines
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[English]

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April 2025